THE INTERNATIONAL SUGAR JOURNAL.

A TECHNICAL AND COMMERCIAL PERIODICAL
DEVOTED ENTIRELY TO THE SUGAR INDUSTRY.

JANUARY TO DECEMBER,

1931.

VOLUME XXXIII.

LONDON:
ST. DUNSTAN'S HILL, E.C. 3
1931.

CONTENTS FOR JANUARY, 1931.

Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix.

The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808. *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR FEBRUARY, 1931.

Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix.

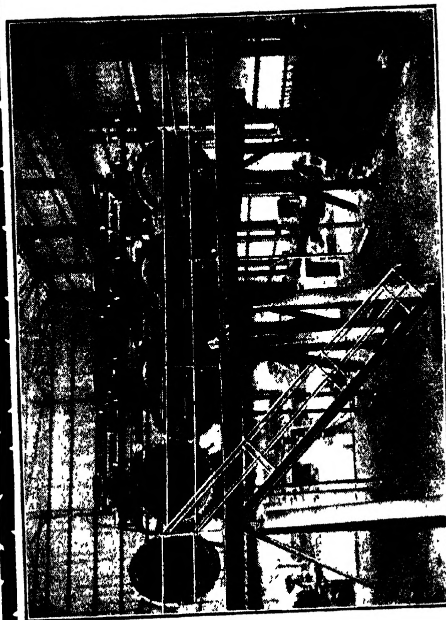
The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808 *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.



Battery of Four Juice Heaters
each having 800 sq. ft. Heating Surface.

Consult

JOHN McNEIL & Co LTD.
Colonial Iron Works,
GLASGOW

When you want the latest improvements in
SUGAR
MAKING MACHINERY
Cable Address: Colonial, Glasgow

CONTENTS FOR FEBRUARY, 1931.

Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix.

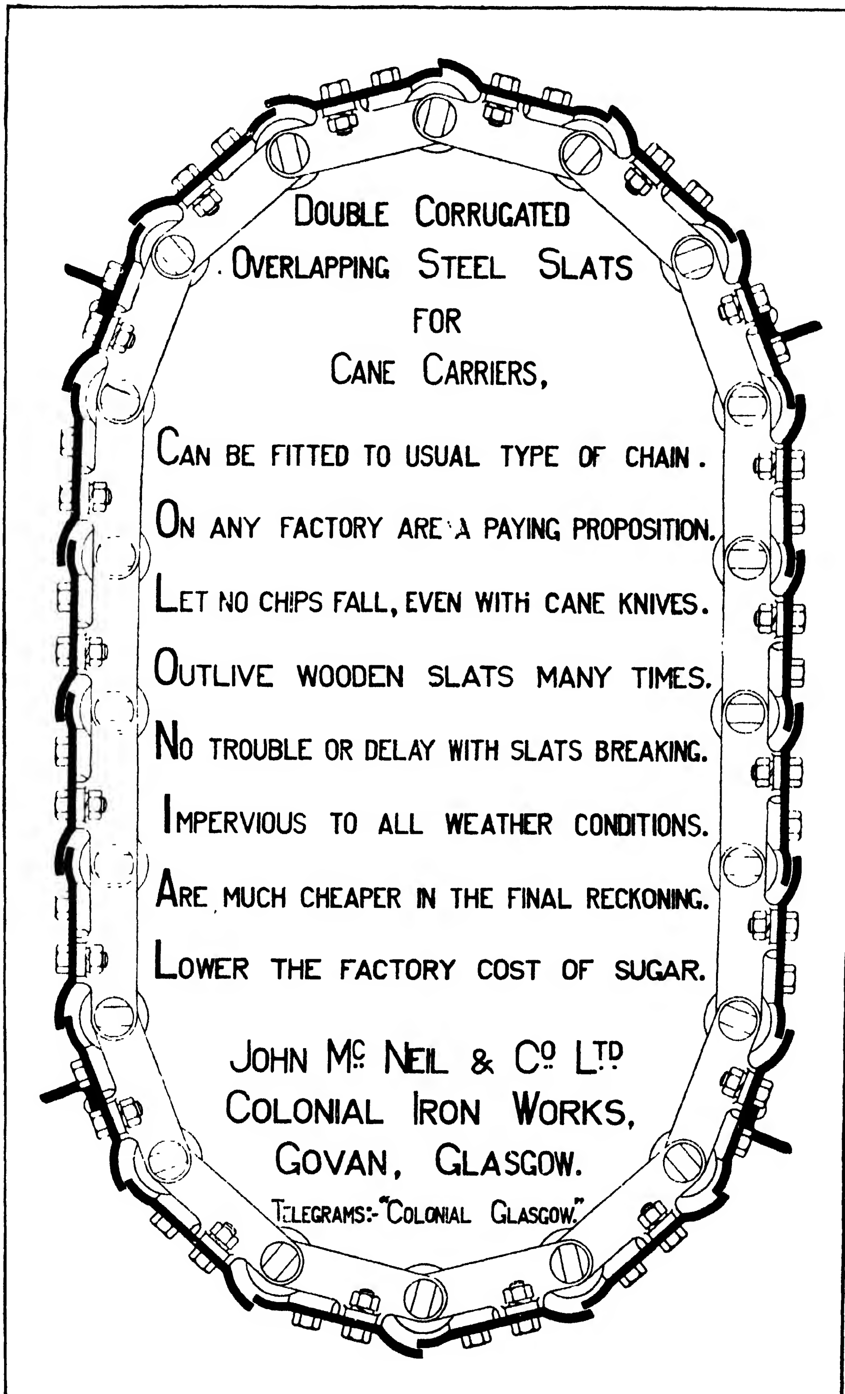
The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808. *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION,
21s., Post Free.

SINGLE COPIES, 1s. 9d.;
2s Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.


DOUBLE CORRUGATED
OVERLAPPING STEEL SLATS
FOR
CANE CARRIERS,
CAN BE FITTED TO USUAL TYPE OF CHAIN.
ON ANY FACTORY ARE A PAYING PROPOSITION.
LET NO CHIPS FALL, EVEN WITH CANE KNIVES.
OUTLIVE WOODEN SLATS MANY TIMES.
NO TROUBLE OR DELAY WITH SLATS BREAKING.
IMPERVIOUS TO ALL WEATHER CONDITIONS.
ARE MUCH CHEAPER IN THE FINAL RECKONING.
LOWER THE FACTORY COST OF SUGAR.
JOHN Mc NEIL & Co LTD
COLONIAL IRON WORKS,
GOVAN, GLASGOW.
TELEGRAMS:-"COLONIAL GLASGOW."

CONTENTS FOR APRIL, 1931.

Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix.

The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808. *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR MAY, 1931.

Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix.

The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808. *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR JUNE, 1931.

Managing Editor - - - - NORMAN RODGER.
Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.-xlix

The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808 *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION,
21s., Post Free.

SINGLE COPIES, 1s. 9d.;
2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.


JOHN McNEIL & Co. LTD
Colonial Iron Works,
GOVAN, GLASGOW.
Manufacturers of
SUGAR MAKING
MACHINERY
of every description
WITH ALL LATEST
IMPROVEMENTS.
Cable Address:
"Colonial, Glasgow."
McNeil's Patent Amod Design Sugar Cane Mill.
Fourteen Rollers Driven by ONE Steam Engine.

CONTENTS FOR JULY, 1931.

Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix.

The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808 *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.


JOHN McNEIL & Co Ltd
Colonial Iron Works,
GOVAN,
GLASGOW.
Cable Address:— "Colonial, Glasgow."
Manufacturers of
SUGAR MAKING MACHINERY
of every description
WITH ALL LATEST IMPROVEMENTS.

CONTENTS FOR AUGUST, 1931.

Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix.

The Journal is published about the 15th of the Month.

Telephone: Royal 9808. *Cables:* Sugaphilos, London.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR SEPTEMBER, 1931.

Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix.

The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808. *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

4

CONTENTS FOR OCTOBER, 1931.

Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix.

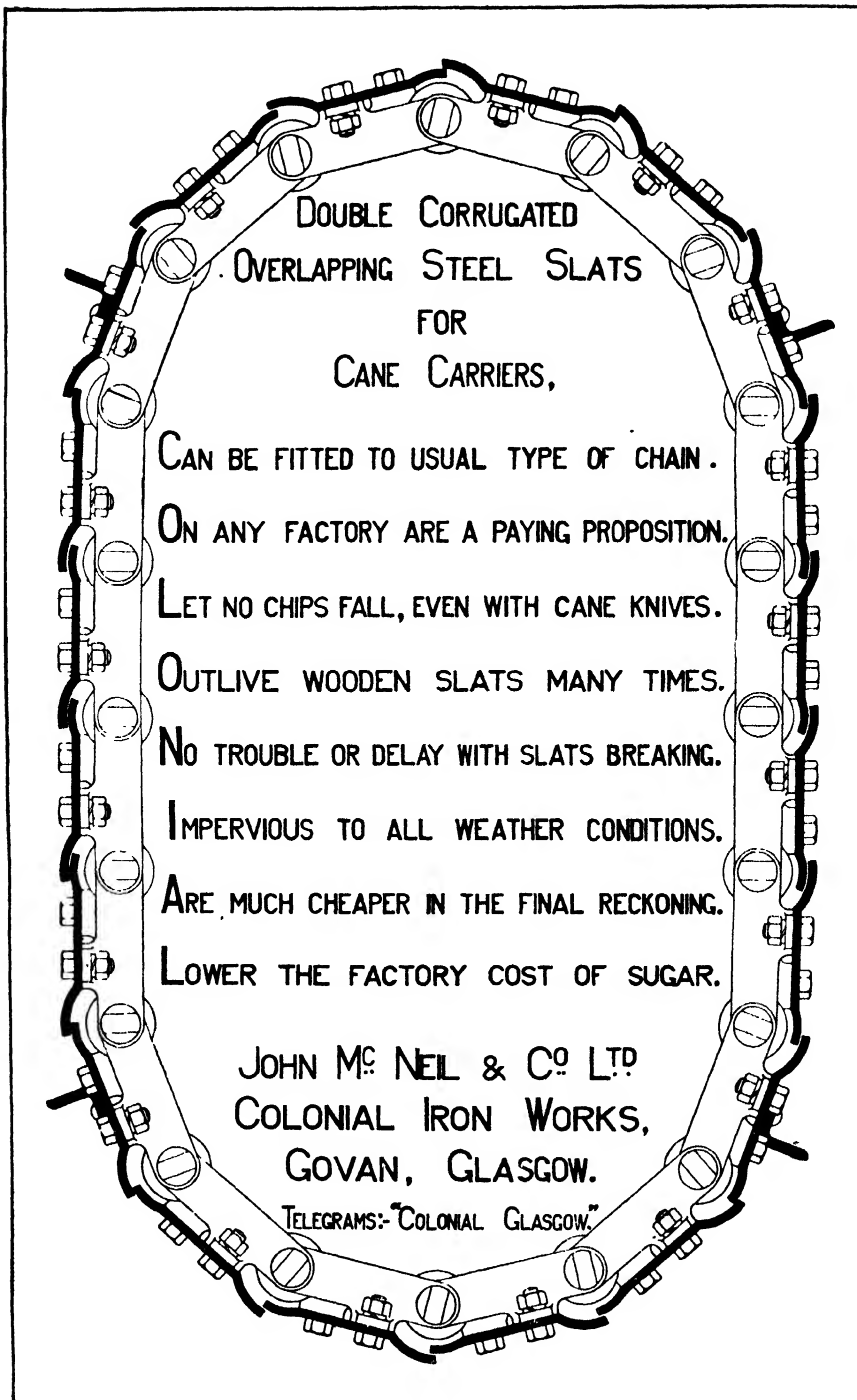
The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808. *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION,
21s., Post Free.

SINGLE COPIES, 1s. 9d.;
2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.


Double Corrugated
Overlapping Steel Slats
for
Cane Carriers,
Can be fitted to usual type of chain.
On any factory are a paying proposition.
Let no chips fall, even with cane knives.
Outlive wooden slats many times.
No trouble or delay with slats breaking.
Impervious to all weather conditions.
Are much cheaper in the final reckoning.
Lower the factory cost of sugar.
John Mc Neil & Co Ltd
Colonial Iron Works,
Govan, Glasgow.
Telegrams:-"Colonial Glasgow."

CONTENTS FOR NOVEMBER, 1931.

Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix

The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808. *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR DECEMBER, 1931.

Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix.

The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808. *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.


JOHN McNEIL & Co. LTD.
Colonial Iron Works
GOVAN, GLASGOW.
McNeil's Patent Amod Design Sugar Cane Mill.
Fourteen Rollers Driven by One Steam Engine.
Manufacturers of
SUGAR MAKING MACHINERY
of every description
with ALL the LATEST IMPROVEMENTS.
Cable Address: "Colonial, Glasgow."

THE INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 385. JANUARY, 1931. Vol. XXXIII.

Notes and Comments.

The Chadbourne Conference: Negotiations in the Balance.

We went to press last month while the Chadbourne Conference was sitting at Brussels, and a month later it has to be recorded that the issue remains in the balance, and pending a final attempt to reconcile certain differences with Germany, the official report of the meeting has been withheld from publication. Enough, however, is known of the general trend of the discussion to reveal where the main obstacle to complete success lies.

The preliminary conversations between Java and Cuba, held at Amsterdam, had some fateful moments, but in the end complete agreement was arrived at between the two parties as to the figures to be submitted to the main conference at Brussels with the beet and cane interests. Cuba agreed to restrict her annual production to 3,570,000 tons plus the 300,000 tons to be taken annually from her 1,500,000-ton segregation. Java agreed to an export of 2,200,000 tons plus a further 100,000 tons to be taken from her 500,000-ton segregation. Mr. Chadbourne was then free to unfold his proposals for the European beet quotas, and these he proceeded to lay before the full conference at Brussels.

This Conference took the production and sale figures of 1929-30 (September-August) as the basis for the negotiations.[1] Mr. Chadbourne then proposed that the European exports of that year, amounting to 1,445,000 tons, should be cut down during 1930-31 by 15 per cent., i.e., to 1,229,000 tons. The allotment to the various countries was: Germany, 200,000 tons; Czecho-slovakia, 590,000 tons; Poland, 319,000 tons; Hungary, 85,000 tons; and Belgium, 35,000 tons. The rock on which the Conference split for the time being was the German allotment, for while this represented a 15 per cent. reduction off the net export figure of 1929-30 of 235,000 tons, it clashed with the hard fact that owing to Germany having increased her beet sugar production this year by about half a million tons, her stocks available for export amount to an estimated figure of 812,000 tons, or more than the figure of any other European country, not excluding Czecho-Slovakia. This inequality was indeed recognized by the other delegates, and there was support for the proposal to allow Germany a higher figure. Reports speak of 300,000 or

[1] See Page 45.

even 350,000 tons a year for the next five years as the concession. However, Germany claimed at the outset the right to an export quota of 450,000 tons in the first year, and 350,000 tons in each of the subsequent four years, and persisted in this claim during the negotiations. As a consequence the Conference broke up without arriving at an agreement, but with the intention of leaving Mr. CHADBOURNE to continue negotiations with Germany and to report to a later meeting of the Conference in the event of a successful outcome of the pourparlers. Before separating for the adjournment, the other delegates signed a protocol, agreeing to their own figures; but, naturally, the permanence of this agreement depends on whether or not Germany's objections can be met and her participation secured. January 15th was fixed as the date when the Conference would expect the report, but as all parties seem anxious to see a successful outcome, it is probable that further time will be allowed if needed before the fate of the Conference is irrevocably decided, and negotiations are finally abandoned.[1]

For the Conference has met with so large a measure of success that the comparatively small differences in tonnage that bar the way to Germany's participation seem a small matter compared with the benefits offered by the agreement as a whole. Complete success would provide the spur for an upward trend of prices that might amount to a shilling or two per cwt. Entire failure might, on the contrary, cause prices to revert to their worst of 1930, that is to drop by another shilling. A difference of £2 to £3 per ton in the price of sugar, according to what is achieved, should certainly not escape the attention of the negotiating parties. Germany, indeed, if she persists in demanding her pound of flesh, may end by exporting more at a lower total return than if she would agree with her rivals on a quota to which improved prices would apply.

It may be asked whence is to come the extra allowance to Germany, if the total production or exportation figures are not to be exceeded. The other European countries have probably conceded as much as can be expected. The Java point of view is said to be that if the cane sugar people wish to grant an increase to Germany, it is Cuba's turn to give up something, and not that of Java. In the course of the Amsterdam negotiations Cuba started with a proposal for allotting her industry a crop of 3,570,000 tons and did not climb down a single pound. Java's idea for her own crop was a figure of 2,500,000 tons, but in the course of negotiations she reduced this to 2,300,000 tons. *Ergo*, Cuba should make the concession now, that would adjust the comparatively small German difference. On the other hand, Cuba can undoubtedly point to the fact that her figure represents a restriction in production of 23·5 per cent., whereas that of Java is no more than 11 per cent. But either way, the Cuban-American interests have really too much at stake to spoil it all for a paltry 100,000 tons or so.

The Conference intends to issue a full report of the proceedings, both at Amsterdam and at Brussels. But pending the final attempts to settle the German quota difficulty and arrive at complete unanimity, the delegates have been pledged to secrecy, and no authorized account of the deliberations is forthcoming at the moment.

[1] Just as we go to press comes the news that Mr. Chadbourne has visited Berlin and had a conference with the German delegates, with results satisfactory to Germany's participation in the restriction scheme. The export quotas to be allowed the Germans have been fixed at 500,000 tons during the first year, 350,000 tons during the second year, and 300,000 tons for each of the subsequent three years. The way is consequently clear for the meeting of the Brussels Conference on the 15th of this month, when it is to be hoped the final adjustments of the European quotas will be agreed to without any further hitch.

The Political Unrest in Cuba.

While Cuba's representatives have been busy in Europe striving to obtain co-operation amongst world sugar producers, a certain amount of political unrest has been evident in Cuba, to judge from press reports from that island. Various degrees of martial law would appear to have been applied by the President in the course of dealing with malcontents, of whom there are always a number engaged in anti-Government agitation. Undoubtedly the stringent economic position in the island and the increasing poverty and want of employment or even of a bare living have accentuated discontent of late months and given excuse for displays of armed insurrection which have had to be suppressed by force of arms. But we think more importance can be attached to the happenings in Cuba than the real facts warrant. The rule of a dictator, such as President MACHADO has so frequently to be, is often rough, but we believe it cannot be gainsaid that the present administration has done more for the Cubans and their public good than any other since the republic was founded. Less money has been wasted and more has been spent on public works, such as the new central highway to be completed next month. MACHADO would appear to be doing better than any other likely president could do ; he is leading on the people to diversified agriculture and has helped to introduce industries to supply the local demands for goods hitherto imported. His political party, the Liberals, remain in the ascendancy and are too strongly entrenched to be easily deprived of the control of affairs. So, unless the force of economic circumstances becomes uncontrollable, it may be assumed that the present Cuban Government will remain equal to the occasion and that the process of re-organizing the sugar industry—however painful to those concerned—will take its due course.

Indian Sugar Production during 1929-30.

The Pusa Sugar Bureau has lately issued a Note on the production of sugar direct from cane in India during the 1929-30 season, from which one learns that 27 factories making such sugar were at work, as against 24 in the previous season. Eleven of these are situated in the Province of Bihar and Orissa, thirteen in the U.P., and one each in Bombay, Madras, and Burma. During the year under review a new factory at Pilibhit, U.P., started work under the proprietorship of the firm owning the factory already working there.

The production of sugar direct from cane by these Indian factories totalled 2,443,486 maunds or 89,768 tons, as against 1,852,322 maunds or 68,050 tons in 1928-29. There was thus an increase of 21,718 tons in the output of sugar. The amount of cane crushed amounted to 26,941,709 maunds, as compared with 21,540,858 maunds in 1928-29. The average percentage recovery of sugar, which has risen from 8·59 in 1928-29 to 9·07 in 1929-30, establishes a record, inasmuch as this is said to be the first time that Indian sugar production has averaged over 9 per cent. yield. The highest recovery is shown by a factory working thick cane, its average for the whole season being 10·8 per cent. The 1929-30 average of 9·07 represents an increase in the course of five years of exactly one per cent., and is the result of a larger proportion of the sugar factories following the lead of the more enterprising ones in striving to achieve more efficient production.

The Sugar Machinery Market in Glasgow, 1930.

According to the *Glasgow Herald*, the year which has just finished contained no element of cheer for the manufacturers of sugar machinery. It was probably one of the worst, if not the worst, on record. Signs pointing to any immediate improvement in the governing factor—the price of sugar—are not at present encouraging. The world price of sugar remained low—in fact, below the cost of production— while the general economic crisis has not induced a proportionate rise in consumption following upon the low price.

The machinery-making industry has been seriously affected as a consequence, and the net result has been acute depression, with only the barest orders placed for necessities in the way of spares and renewals. No work of any importance has been done in respect of building new British beet sugar factories, although Messrs. Duncan Stewart & Co., Ltd., have carried out extensions at some of these plants and, in particular, have installed machinery embodying a successful system for the treatment of effluent waters to prevent pollution of streams ; an item of great practical importance for the beet sugar factories.

At the present moment there are some serious inquiries for the construction of sugar plant and machinery contemplated by countries having a protected home market, and arising from these there is reasonable prospect of orders being placed here.

The Outlook for Sugar Machinery Business.

Complementary to the above remarks, we may conveniently add here some views of the president of a leading American sugar machinery firm, as to the immediate outlook. According to him the depression of the last few years in the sugar industry has led to sugar manufacturers limiting purchases of spares and replacements to a minimum. Thanks to this sub-normal maintenance, to skimping on repairs, etc., the average sugar mill has been subjected to excessive abuse and the need to-day for new parts is abnormal. How soon these needs will be met is of course a financial one, dependent on how soon sugar production becomes remunerative once more. But when this stage arrives, it will probably be found that the average sugar company will avoid capital expenditure on expensive milling equipment till the greater need for more urgent repairs and replacements has been met. In the view of this American engineer, the results of the Chadbourne Act in Cuba if fully carried out will tremendously alleviate the situation there and permit the rehabilitation of many of the factories which are obsolete in equipment and methods, and which are unable to produce sugar economically. In Porto Rico some of the sugar companies, in spite of the present stress, are in a sufficiently sound condition financially to plan the provision of new milling tandems ; but generally speaking, the first step to take by most companies as soon as the way is clear will be to repair and renovate the existing plant and apparatus.

STANDARD PRICES FOR MAXWELL PRODUCTS.—For a variety of reasons it has long been the standard practice of engineering firms not to publish any printed prices for their sugar machinery, but to supply these figures to their agents, so that would-be clients must either approach those agents or the firms direct for the prices of any machinery they desire. One producer of machinery has now departed from that tradition, inasmuch as Dr. Francis Maxwell, the patentee of the Maxwell Crusher-shredder, has started publishing standard prices for his apparatus. In his view, just as the prices of different sizes of motor cars are known to the public through their advertisements, so now the prices of the different sizes of Maxwell Shredders should be available, without first referring to agents or licencees. Under this arrangement greater convenience and advantage to prospective clients accrue.

Sugar Freights in 1930.

(From a Correspondent).

Conditions in general chartering throughout the whole of 1930 have been very difficult for owners, and the past year has been one of the very worst on record in regard both to freights and the amount of tonnage taken up by shippers. Recordly low and even pre-war rates have been noted in many directions and the amount of laid-up shipping in all parts of the world has grown to abnormal dimensions.

Sugar chartering during 1930 experienced acute depression with recordly low freights established from Cuba and Mauritius, whilst the crisis in the sugar industry brought chartering from the former completely to a standstill by mid-October.

In regard to Cuba, quite a good business was arranged during the first quarter of 1930, although the severe general depression had already forced freights down to the low figure of 12s. per ton to the U.K.-Continent. The successive collapses of the River Plate grain market during the whole of the past year had a most demoralizing effect on the Cuban sugar market; the latter being repeatedly undermined by the offers of cheap ballast tonnage from that direction. During May the general depression became more acute than ever, the index number of shipping freights for that month being the lowest on record, and a large amount of distressed tonnage was diverted from the River Plate and also Montreal to Cuba and Chile. Sugar shippers were thus enabled to secure ballasters at the recordly low rate of 11s. 6d. for the U.K.-Continent, this being the lowest figure noted for many years past. Chartering during June was maintained on a fairly active scale with rates on the basis of 11s. 9d. to 12s. 1½d. despite the fact that there was then fully five million tons of shipping laid-up in various parts of the world. A large number of vessels were also arranged about this time on the time charter basis for one West Indies round, delivery and re-delivery not North of Hatteras, at very low rates ranging from 70 cents to $1·20 according to size of vessel. By July fixing to the U.K.-Continent had quietened down considerably with terms ranging from 12s. 4½d. to 14s. 6d. An outstanding feature during this month was the sale of 200,000 tons of Cuban raw sugar to Russia, 135,000 tons of which was shipped to the U.K. to be refined and then sent on to Russia, whilst the remaining 65,000 tons was sent direct. In this connexion tonnage was arranged from Cuba to the Black Sea at 16s. and to Leningrad at the very low rates of 15s. to 15s. 3d., whilst a boat was also arranged for the shipment of sugar from Greenock to the Black Sea at 11s. During August and September only a very small business was arranged from Cuba to the U.K.-Continent and by mid-October the critical state of the sugar industry brought chartering completely to a standstill, rates being on the basis of 13s. 9d. at this time. Fixing during November was utterly neglected and chartering in December was confined to a few part cargoes at the very low rate of 12s. 6d.

In the Mauritius sugar market the fixing of "tramp" tonnage was in narrow compass throughout the year and the main points of interest were the two contracts concluded with the Clan Line for the shipment of Mauritius sugar to the U.K. during 1930, 1931 and 1932. Early in March last a contract was arranged with this line for the shipment of about half the crop (100,000 tons) at the low rate of 22s. per ton during September, 1930, to January, 1931, this employing about fourteen vessels. In December, 1930, a similar deal was negotiated for 100,000 tons of the 1931 Mauritius crop to be shipped to the U.K. at the even lower rate of 21s. 6d. during October, 1931, to March, 1932.

Only a very small business was arranged by "tramp" tonnage and rates were kept down at very low levels on the basis of 20s. during June and July, although some little improvement was noted late in September when 23s. 6d. was secured owing to a temporary scarcity of tonnage in that direction. Chartering then came completely to a standstill and idle conditions prevailed over the end of the year.

Results and Object Lessons from a Half Century of Cane Breeding.[1]

By NOËL DEERR

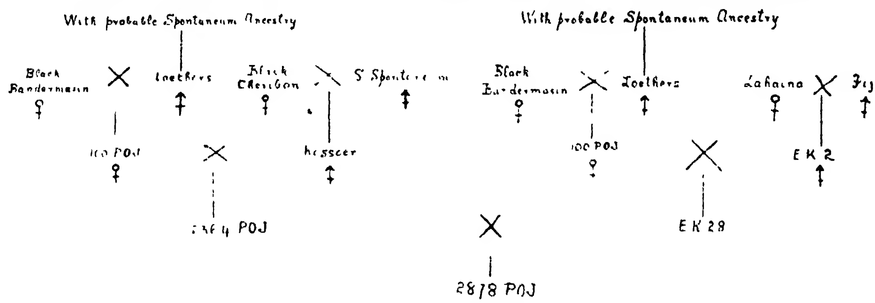
In presenting this paper on cane breeding, I wish as a preliminary to state that no original work of the writer is brought forward. In this subject his position is merely that of the intelligent and interested layman, and it is the importance to India of this work and of its object lessons, that have decided him to present this short note, which includes for the proper understanding of the position a short historical sketch.

Some time prior to the year 600 of the Christian era the sugar cane travelled westwards from India, and through Arabic influence became firmly established in the Mediterranean littoral as early as 800 A.D. Although as early as 400 B.C. the Indian writings of Charaka and Susruta mention as many as twelve varieties of sugar cane then recognized in India, it seems certain that only one variety escaped thence, and this was up to 1780 the only one known in the Western Hemisphere. From its long period of cultivation in the West Indies this cane has become known as the Creole cane. It has lately been positively identified by the present writer as the Puri cane which is still grown to some extent in Bengal and South Bihar.

This Puri cane or Creole cane is sterile and does not set fertile seed. From this peculiarity arose the fallacy that all sugar cane was sterile and that attempts to obtain improved strains by means of sexual variation were necessarily abortive. That this fallacy was accepted and endorsed by authority for so long is remarkable, since RUMPH, a Dutch botanist of the seventeenth century made a definite statement to the contrary, and later in 1858 in Barbados, in 1862 in Java, and in 1871 in Réunion cane seedlings were actually grown and the statements recorded in accredited publications. Nevertheless, when SOLTWEDEL in Java in 1887, and HARRISON and BOVELL in Barbados in 1889, announced the fertility of the cane, their observations were received with some degree of suspicion and were not at once accepted. This re-discovery came at an opportune moment, for at that time a disease known as Sereh was doing great damage in Java and a condition known as the rind fungus was equally serious in the West Indies. It was, therefore, imperative that efforts should be made to introduce new stock, and to both KOBUS in Java, and to HARRISON and BOVELL in the West Indies the new knowledge supplied the means. The methods of operation pursued by the two earliest pioneer cane breeders were very different. In Java from the very first a system of controlled hybridization was carried on, with the result that the parentage of nearly all the sexual variants obtained in Java is known, and from the records a vast mass of ordered information has by this time accumulated. In order to work on these lines detailed studies of the cane flower

[1] Paper read at the Indian Science Congress, Allahabad, January, 1930. Reproduced from *Agr. Jl. India*, xxv, II, 100-3.

had to be made, such as the separation of the different varieties into those which had fertile and infertile pollen and those which had developed and abortive ovaries. A second feature of the work in Java was the choice as one of the parents of a cane which had been observed to be immune to the Sereh disease. The parent cane selected for this purpose was the Chunnee cane of Northern India which subsequent research has shown to be a natural hybrid with ancestry including both *Saccharum spontaneum*, the Kus grass of India, and *Saccharum officinarum* or the sugar cane proper. Anticipating somewhat the sequence of events, it will be convenient to give a very short résumé of the phases of the Java researches. Starting with Chunnee as the male parent, a series of canes immune or nearly so to Sereh was obtained; included in them were the canes POJ 33, 213 and 228 which obtained some extension in cultivation. These did not possess good cultural characteristics, and after the Sereh disease had been put under control by other means the Chunnee strain was given up and breeding from noble canes was adopted. This period gave as a result two canes, 100 POJ and 247 B, which, for at least 15 years, occupied much of the cane areas in Java. At a later date the series of canes with initials EK, DI and SW were bred, also with complete noble cane ancestry, and till a few years ago canes of these three series were the dominant canes in Java. A very decided move in another direction, again introducing wild blood, was made by JESWIET about fifteen years ago. He introduced both as male and female parents the Kassoer cane. This cane was found in a semi-wild condition in Java, and it was suggested by JESWIET



in 1916, a supposition since amply confirmed, that this cane is a natural hybrid between *Saccharum spontaneum* and the Black Cheribon cane which previous to 1900 was almost the only cultivated type in Java. The Kassoer strain, or going a step still further back, the *Saccharum spontaneum* strain is now considered an essential in the parentage of the newer sexual variants produced in Java, because of the disease immunity so introduced. To round off this brief description of the development of a system of cane breeding in Java, there is given in the following Figure the ancestry of the cane POJ 2878 which epitomizes the result of forty years' patient and intensive studies in Java. To obtain this result no less than 392,871 seedlings have up to 1925 been planted out, all of which have been obtained on ordered lines and the ancestry of most of which is known.

Simultaneous with the development of the subject in Java by KOBUS and his successors, HARRISON was at work in Demerara. He operated on a system of mass production, using only noble canes as the parent and, as far as I can gather from available accounts, concerned himself only with the female ancestry of the sexual variants he produced. Mainly, I take it, because of lack of essential means, his work lacks the wealth of detailed

observation found in the Java records, but at the same time it has been of great value in the production of canes which have occupied extensive areas. Amongst these are the canes D 74, D 95, D 117, D 1135 and D 625, the third and fourth of which are still valued canes in Hawaii and the last of which remains the dominant cane to-day in Demerara.

A little later than in Java and Demerara, the production of sexual variants was undertaken by ECKART in Hawaii. He, too, operated on mass production methods with absence of the control of parentage ; his work has been so far successful as to include the cane H 109 which, under the system of intensive cultivation and irrigation there practised, has produced per acre tonnages of cane and sugar far in excess of what has been obtained elsewhere.

Work also of value has been carried on in Barbados and among the earlier canes produced were two, B 147 and B 208, which obtained some extension in cultivation. More lately a series of hybrids of ascertained parentage has been produced, among these being BH (10) 12, B 417, and B 11569, all descendants of B 6835. and all remarkable for exceptionally high sugar content, but at the same time not remarkable for tonnage or yet immune to disease. I further gather from references in journals that work is now in progress in Porto Rico with the object of obtaining hybrid sexual variants between POJ 2878 and these canes, so that disease immunity, high tonnage and high sugar content may be united in one cane.

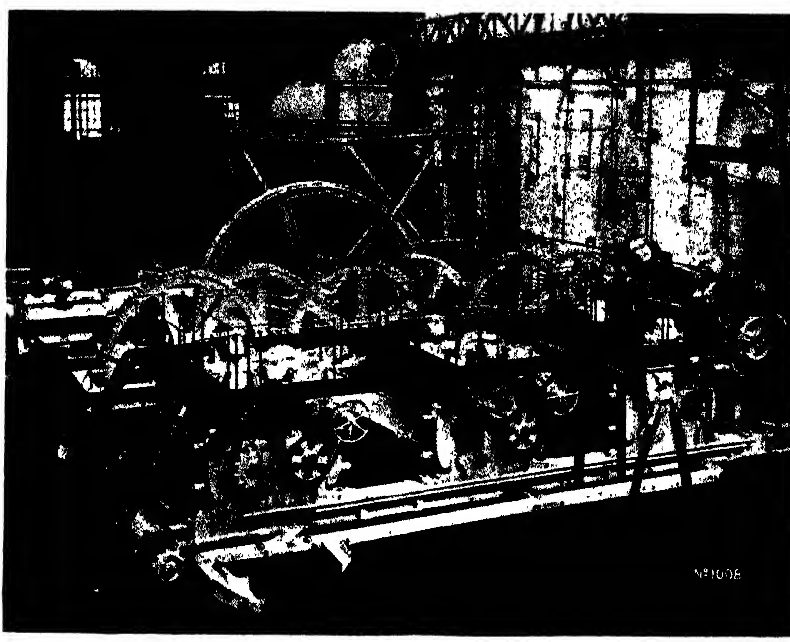
I have left to the last any mention of work done in India, as it contains points of difference from work elsewhere. Cane breeding was begun by BARBER in India in 1912, and the problem before him was to develop a strain of canes which would be suited to the climate and conditions of Northern India. BARBER started his breeding work using *Saccharum spontaneum* as a parent, and although Chunnee, itself a hybrid with *Saccharum spontaneum* as a parent, had been very early used and Kassoer had been used later, it was not till after BARBER'S work had started that the parentage of these canes was visualized. It is, therefore, to BARBER, I think, that the credit of introducing *spontaneum* blood into strains of cane intended for extensive planting should be given. As in Java also, BARBER'S work, which has been well followed up by VENKATRAMAN, contains a great mass of detailed and valuable observation, and it is a pity that he reached the age of retirement before his work was completed and that he had to leave his tale half untold. Of the canes bred by BARBER at least 300,000 acres are under cultivation now in Northern India, and the benefit thereto reaches annually to many lakhs of rupees.

In concluding this very brief résumé of a subject of essential importance to India, I wish to emphasize the point that what results have been obtained have derived from laborious and painstaking work lasting over nearly fifty years and undertaken in a proper spirit of research. Often this work has been hampered by apathy and even by covert opposition. Capitalists and Governmental authorities have, through lack of appreciation of the mass of work required. often demanded results at too early a period, and not infrequently too, results have been delayed following on a policy of spurious and ill-advised economy. It is not until it is accepted on all sides that industry is dependent on research that progress will be made, and the progress made will bear a direct ratio to the support afforded by Governments and capitalists to the research worker.

"CONTROLOGRAPH."—This is a precision recording instrument for locomotives, which gives the following data, among others : Trips made, times of trip, distance covered, speed, stops, time of stops, total mileage travelled, and total in hours and minutes of the actual run.

Estd. SMITH 1837.

DESIGNERS AND MANUFACTURERS
OF
CANE SUGAR MACHINERY
OF EVERY DESCRIPTION



11-Roller Sugar Cane Crushing Plant.
Photographed in one of our Erecting Shops.

A. & W. SMITH & Co. Ltd.
Eglinton Engine Works, GLASGOW

Telegraphic Address · "Engine," Glasgow.
London Office — 8, Grosvenor Gardens, S.W.1.

First Annual Conference of the Queensland Society of Sugar Cane Technologists.

In April of this year the first meeting of the Queensland Society of Sugar Cane Technologists took place at Cairns under the presidency of Mr W F. SEYMOUR HOWE. Mr. HOWE remarked in the course of his address that "the desperate need into which the Queensland sugar industry had fallen as a result of over-production in conjunction with the peculiar economic circumstances the white sugar policy increasingly demands no effort individual or collective should be spared in modelling our sugar progress on the highest scientific lines." Wholehearted support of the manufacturing section had been obtained, with the exception of the C.S.R. Co., which was unrepresented on the ground that it possesses its own complete technical organization. However, it was hoped that later the Company will co-operate for the exchange of scientific and technical experience. A number of papers were read at this first meeting, abstracts of some of which are here presented. Mr. NORMAN BENNETT, Government Mill Technologist, is Secretary of the new Society.

ACID SOILS, AND SOME RESULTS FROM LIMING.

Dr. H. W. KERR, Agriculturist, Experiment Station, Brisbane, and E. J. BARKE, Chemist-in-Charge, Experiment Station, South Johnstone, gave an account of their experiments on the application of lime to the alluvial soils extending from the Herbert River to Mossman. Yields of cane per acre were: No lime, 32·9; 1 ton of burnt lime, 39·1, and 2 tons of burnt lime per acre, 40·8; while in the case of the first ratoons the corresponding figures were 31·1, 35·4, and 38·7 tons. Hence in these particular tests it would seem that 1 ton of lime sufficed for the plant crop, but that 2 tons were desirable for the ratoon crop. The acidity tests employed were those of JONES and HOPKINS based on a determination of the titratable acidity produced when a solution of a neutral salt is shaken with a measured quantity of the soil, calcium acetate being used in the JONES method and potassium nitrate in the HOPKINS. They had also determined the *pH* of the soil extract electrometrically by the quinhydrone method, obtaining values following the same general trend as the titratable acidity tests. Values are thus obtained showing the limit above which liming is unnecessary, and below which a dressing should be given. The lime is best applied after the last ploughing and at the conclusion of the wet season the soil should only be slightly harrowed, when there would be a minimum loss due to leaching.

NOTES ON CRYSTALLIZER WORK.

H. E. TURNER contributed some details of crystallizer practice in Queensland. Crystallizer massecuites, he said, are grained with the addition of icing sugar, concentrated to a high Brix, dropped at 60°C., and kept in motion for 50-72 hours, being "lubricated" with water 12 and 24 hours before dropping. The temperature of the massecuite entering the mixer is in the vicinity of 42°C., and if the massecuite does not dry freely, hot water or hot molasses is added in the mixer. Grain is on the small side, and the purity of the molasses boiled on, which is heated and diluted to 70° Brix to dissolve any false grain present, is maintained about 55°. The average drop of purity in the pan before entering the crystallizer is 18-20°, and in the crystallizer a further drop of 4-6° is obtained according to the temperature at which it is dropped, the average drop for the past season to final molasses having been 25°. Average

figures for six crystallizer massecuites of 63·5° purity, adding water at both 72 and 144 hour periods were as follows :—

Temperature °C.	62°	53°	46°	42°	40°	36°	35°	34°	32°	30°	30°
Purity	45·5	43·2	41·1	40·0	37·6	36·9	35·7	35·0	34·1	33·7	34·0
Hours in Crystallizer	—	24	48	72	96	120	144	168	192	216	240

In the discussion, Mr. BENNETT said that from a study of the Cuban-American Company's results there appeared no appreciable difference between water or dilute molasses when used for lubrication. In Java one of the factories found that when the molasses was added below 85°C. there was danger of solution of crystal.

pH CONTROL IN DEFECATION.

NORMAN SMITH described four series of clarification tests with juices from Badilla, EK 28, and M 1900 Seedling, sub-samples from the 1st and 2nd mills being limed and briskly boiled for 30 secs., and allowed to settle in tubes 1⅝ in. diam., and 23 in. long, set in a frame. The height of the mud was noted at intervals of 10 min., and determinations made of the purity, reducing sugars, ash, P_2O_5 and *pH*. Here are the results obtained in the case of the juice of M 1900 Seedling, which had a purity of 80·86, and contained 0·32 per cent. of ash, 1·49 of reducing sugars, and 0·419 of P_2O_5 :—

No. 4. 16/12/29 VARIETY OF CANE—M 1900 SEEDLING.

pH	7·80	6·80	6·70	6·10
Purity	82·95	82·43	82·22	81·22
Ash	0·29	0·29	0·28	0·28
Red. sugars	1·10	1·19	1·16	1.16
Grms. P_2O_5 per litre	0·049	0·069	0·071	0·077
Mud vol. after :—				
10 min.	0·34	0·28	0·34	0·27
20 min.	0·22	0·22	0·27	0·18
30 min.	0·20	0·19	0·23	0·16
45 min.	0·17	0·17	0·21	0·15
60 min.	0·16	0·16	0·19	0·13

The first Badilla juice gave a maximum increase of purity of 4·2 at 8·0 *pH*; the second Badilla of 0·2 at 8·4 *pH* ; and the EK 28, 1·4 at 8·4 *pH*. The P_2O_5 content of the juice is the vital factor, and in general the maximum increase of purity is found at the *pH* values indicating high liming. A knowledge of the P_2O_5 content of the juice should give an approximate idea of the purity increase to be expected, as well as the amount of mud and the settling rate for a given *pH*.

HYDROGEN-ION CONCENTRATION, AND ITS SIGNIFICANCE.

C. H. O'BRIEN in his paper outlined the meaning and significance of H.I.C., and gave some particulars of its determination. He stated that there seemed to be objections to the making of buffer solutions in the ordinary sugar-mill laboratory. They may be bought in sealed tubes, but the makers will not guarantee their permanence for more than a year, and then only if not exposed to heat and light. There is, however, a form of Comparator (the Hellige) which dispenses with buffer solutions, using a series of colour discs which reproduce the indicator colours. Ionization is markedly affected by temperature, and it is therefore desirable to make all readings as closely as possible to 22°C., though an increase up to 30°C. will not affect the result by more than 0·1 *pH*. Using dilution water variously from 6·0 to 6·4 *pH*, it was

found possible in many cases to dilute up to 100 to 1 without seriously altering the pH in the cresol red range. But in the bromphenol blue range a marked movement was noticed with a dilution of only 20 to 1. At a 4 to 1 dilution a maximum average deviation of 0·2 pH was shown at 7·2 pH in the b.t.b. range, while in the phenol red and cresol red ranges almost complete agreement was obtained between the diluted and the undiluted juices. It appears, therefore, that with juices within about 6·0 to 8·6 pH, dilution to the extent of 4 to 1 is not likely to cause any serious error, and such dilutions make it easier to obtain an accurate reading. In such places as maceration baths, settling tanks, inversion may occur, which though not detectable ordinarily may be considerable in the aggregate. The easily applied methods which have become available for determining pH values now make it possible to study the matter on a scientific basis.

Clarification on a Basis of H.I.C. Control.

Ewan B. G. Cameron read a paper on this subject. At the commencement of the 1929 season a Helligo Comparator with permanent coloured glass standards was obtained, and it appears to be ideal for the colorimetric determination of pH in clarification tests. Quantities of 200 c.c. of mixed juice were treated in Erlenmeyer flasks with regularly increasing amounts of pure CaO from 0·005 grm. upwards, 100 c.c. of this cold limed juice being transferred to a 100 c.c. cylinder, and allowed to settle for half-an-hour, when pH determinations and measurements of the depth of settlings were made prior to heating. The remaining 100 c.c. was heated in the flask just to boiling, poured into a 100 c.c. cylinder, allowed to settle for half-an-hour, and the same observations made. In discussing the results obtained, the author remarked that the feature that appears to be most apparent is the increasing and diminishing volume of settlings accompanied by the decreasing and increasing degree of turbidity. Decided clarification effects always appear at the points when the volume of settlings reaches a maximum, the optimum being at 7·2 pH. Whether any technical value can be placed on this phenomenon is hard to say. Several experiments which were carried out with a solution of sodium phosphate and calcium phosphate indicated that the volume of precipitate formed when the solution is treated under similar conditions to the above bears a striking resemblance to the increasing and diminishing volume of settlings obtained from cane juice. Probably this can be taken as an indication of the important part that P_2O_5 plays in clarification. The next point is the marked clearance of the juice taking place between 6·7 and 6·9, when the juice has only a slight turbidity. Juice at 8·0 pH is dark in colour. One must also consider the decrease in pH observed after adding an increased quantity of lime, resulting in an inferior clarified juice.

In view of the unsatisfactory nature of results obtained from laboratory clarification unless performed under almost ideal conditions, the most reliable information for practical purposes would be derived from observations made on samples of mixed juice after passing through the juice-heaters prior to entering the subsiding station. One would thus be able to obtain samples under actual factory conditions which cannot be duplicated in the laboratory. However, the pH giving the maximum clarification effect does not necessarily fulfil all requirements, danger of inversion on the one hand and of glucose destruction on the other being present. Walton, McAllep and Hornberger[1] determined that no inversion was apparent during evaporation and boiling when the pH of the concentrated products (at 15° Brix) was not below 6·8 pH. And Bomonti[2] determined that the destruction of glucose

[1] *I.S.J.*, 1925, 265. [2] *I.S.J.*, 1926, 664.

first became evident at 8·25 *pH*. Mr. BENNETT in discussing this paper remarked that there was an improvement in clarification in Queensland last year to be attributed in no small measure to *pH* control. No definite *pH* can be recommended to any one mill, as there are different circumstances and qualities of cane in various districts, that have a bearing on the matter. There is generally a necessity for increased subsider capacity, as with higher liming a greater increase can be obtained in the purity from mixed juice to syrups. The result of clarification with a higher *pH* goes right through the boiling process, showing its effect in the increased net titre sugar obtained. Dr. KERR lastly said in regard to *pH* determinations he was strongly in favour of electrometric rather than colorimetric methods.

MILLING PROBLEMS IN RELATION TO TONNAGE-FIBRE RATIOS.

E. W. DUUS gave an account of milling tests, the object of which had been the measurement of the effect on the H.P. of the variation of fibre, settings, and maceration, other factors being kept as constant as possible. Series *A* tests were made on the 1st unit of a 4-mill train having 5 ft. rollers, grooved with 1 in. pitch and 1 in. depth, and toggle gear ; Series *B* on the 4th unit of the same mill, but equipped with the off-set type of hydraulics, and similarly grooved ; and Series *C* on the 4th unit of another 4 mill train, having rollers 4 ft. 6 in., their grooving being $\frac{11}{16}$ in. pitch and $\frac{3}{4}$ in. depth. Analysis of the figures resulting from Series *A* gave the following summary :—

Fibre		H.P.		Cane Variety.
16·20	.	138	..	EK 28 Ratoons, Burnt.
11·43		143½	..	EK 28 Plant, Green.
11·29	.	120	..	EK 28 Plant, Burnt.
10·54	.	117	..	1900 Seedling Plant, Burnt.
10·53	.	107	..	Badilla Plant, Burnt.
10·22	..	109	..	Short Badilla Plant, Burnt.
9·86	.	78	..	Badilla Plant Green.
9·33	..	97½	..	Long Badilla Plant, Burnt.

From these and other figures obtained in Series *B* and *C* tests the inference is drawn that in general the greater the fibre content, the greater the H.P. expended, though distinct variations are to be noted, the H.P. for the E.K28 plant green cane with 11·43 per cent. fibre, for example, being greater than for the EK ratoons burnt with 16·2 per cent. of fibre. Then from the results of the Series *A* tests, the following table was compiled, in which column *I* is the lbs.-fibre-hour, divided by the sq. ft. roller surface per hour ; *II* is the H.P. ; and *III* is *II* divided by *I*.

	I.		*II.*		*III.*
Badilla	1·36	..	78·0	..	57·2
	1·39	..	97·5	..	70·0
	1·67	..	107·0	..	64·0
EK 28	1·73	..	120·0	..	69·3
	1·75	..	—	..	—
	1·77	..	143·5	..	81·0
1900 Seedling	1·34	..	132·0	..	98·8

These results, the author says, illustrate the truism that the "nature of the cane has a great influence on its milling qualities, so that 1900 Seedling with a fibre figure of 1·34 requires 132 H.P., whereas Badilla with 1·39 takes only 97·5. A point mentioned incidentally was that 1900 Seedling would not take maceration as kindly as Badilla and EK 28, particularly the latter which absorbed most readily. Lastly, the author emphasized the great difficulty in realizing uniformity in such milling tests.

Prime Movers in Sugar Mill Practice.

Wm. Pollock and A. Coyle argued in favour of electrical mill drive. They said the requirements of economical operation at various rates of crushing have been met by the use of a separate turbine generator unit, equipped with a governor which can be adjusted to vary the frequency and voltage of the A.C. power and thereby vary the crushing rate over a range from 75 to 110 per cent. of normal collective power. Control of the crushing rate and the varying of the speeds between mills can also be obtained at a remote distance, thus giving complete control to a single operator on the mill platform. In starting up the mills it is not necessary to wait until one motor has reached full speed before another is started. Speed adjustments are provided to correct the inaccuracies of roller settings, wear of rollers, and changes in the fibre content of the cane, and thus obtain the maximum extraction from each mill. The early objection to electrical drive for mills with standard A.C. motors was the inability to start under heavy torque; but a motor has now been designed to overcome this, its simplicity of control and low running costs commending it to sugar manufacturers. A further saving in power is obtained by having all the gearing fitted with roller or ball type bearings. In a factory where all the units are motor-driven, the only waste steam comes from the generator turbine or steam engine, so the effects and pans are placed close up to the power-house with as short a length of exhaust piping as possible. In Queensland a number of mills are equipped partly with electric motors as prime movers; others are installing motors, actuated mainly with the object of saving fuel.

Mill Lubrication.

G. W. Harding (of the Vacuum Oil Pty., Ltd.) said that in view of the mechanism of film formation, the lubrication of mill journals provides extremes in high pressure and low surface velocity. The average bearing pressure on the projected area runs up to 1000 lbs. per sq. in. in modern sugar mill practice. Pressures in Queensland mills are estimated as from 700 to 1000 lbs. per sq. in. on top roll journals, and in Cuba over 1200 lbs. While these pressures are high, they are not excessive, as 1000 lbs. per sq. in. occurs frequently in internal combustion engine big ends and similar high duty bearings. The difficulty in sugar-mill lubrication is in the very low surface velocity of the journals. This is from 10 to 15 ft. per min. and as film pressure in the bearings depends on viscosity and velocity, a lubricant of very high viscosity is necessary in order to maintain a film. These slow speeds introduce an attendant adverse effect in that the lubricant is squeezed out of the clearance through end leakage, often before the high pressure area is reached. The position of the point of oil entry has an important bearing on the effectiveness of the lubricant introduced into the clearance. The approximate film pressure distribution curve for a top roll brass shows that the point of maximum pressure is offset towards the feed side, owing to the usual practice of setting the mills close on the bagasse side. This obliquity of bearing load, incidentally, is liable to cause lubrication difficulties in hydraulic mills with floating top rolls, owing to partial seizure of the cheek surface, unless special attention is given to grooving and application of oil. For the application of oil, a well designed mechanical lubricator is more reliable and accurate than hand lubrication or wick feeding. It has the advantage that oil can be delivered at the proper point, whereas with any form of gravity system grooves are necessary where a film of fairly high pressure should normally exist.

The Use of the Refractometer in Cane Seedling Selection Work.

By N. CRAIG, M Sc., Sugarcane Research Station, Mauritius.

Many seedlings may be rejected for such reasons as bad habit, susceptibility to diseases, etc.; but the final choice should be decided by the weight of the cane in the stool and the richness in sucrose, i.e., the two factors which determine the yield of sugar per acre. Of the two latter points, the sucrose content of the cane, which shows no correlation with the weight, is the more difficult to determine. It is not desirable to cut all the stool, or even a large part of it in order to crush it, for several reasons, not the least of which being the labour and time necessary for the large number of sucrose determinations. Again, this method does not allow of determinations being made at different times to distinguish between early and late maturing varieties.

Consequently it was thought that by the use of a refractometer reliable evidence regarding the sucrose content of the juice might be obtained without having to cut the cane. The work reported in this paper was performed with a view to getting some idea of the reliability of the results obtained with this instrument. The object of cane seedling selection work being to choose those plants capable of giving high yields of sucrose per acre, it is not so much the sugar in the whole stool that counts, as the capacity which it has of producing sugar. It may well be, therefore, that only well developed and mature canes should be sampled, these having produced their maximum sugar content.

EXPERIMENTAL.

In the first series of experiments, single well developed canes from different varieties were cut. The refractive indices of samples of juice from different parts of the cane, the refractive index of the mill juice (*R*14) and the Brix and sucrose by polarization were then determined. The method of procedure for the determination of the refractive indices of the spot samples was as follows :—Each cane was sampled at three points : namely, one-quarter of the way down the cane, at the centre, and three-quarters of the way down, these giving the results *RI*(1), *RI*(2) and *RI*(3), respectively. The samples were taken by cutting a core out of the cane at the selected points by means of a cork-borer of approximately 5 mm. diam., and the core thus obtained squeezed by a pair of cutting pliers, the juice expressed being placed on the prism of a Zeiss refractometer. This mode of procedure, whilst being very simple, is quite efficient and extremely rapid, the sampling taking much less time than the actual determination of the refractive index. The canes were then crushed singly in a small power mill, and the juice analysed as above mentioned. The results of these analyses are tabulated in Table I.

Later, 27 seedlings actually under selection were taken for analysis. The whole stool was cut, and on reaching the laboratory, the stools were weighed, and the six best canes chosen for determinations of the *RI* of spot samples. These spot samples were taken one from each of the six chosen canes, two from the top positions, *RI*(1) and *RI*(2), two from the middle, *RI*(3) and *RI*(4), and two from the bottom positions, *RI*(5) and *RI*(6). Afterwards the whole stool was crushed, not six canes only, and the usual determinations on the mill juice were made. The results of these analyses are tabulated in Table II.

Discussion of Results.

It is a matter of common knowledge that the refractive indices of cane juices clarified by means of the minimum quantity of neutral acetate give reliable data as to the amount of solids, the amount indicated being generally higher than the Brix solids. From the result of six determinations, it would appear that the refractive index of the non-clarified juice is somewhat higher than that of the clarified juice, the mean difference, in six analyses being equivalent to 0·53 per cent. sugar. The determinations of the refractive index reported in this paper were, of necessity, made on non-clarified juice,

Table I.

First Series—Determinations of Sucrose (Polarization), Brix and Sucrose calculated from the Refractive Indices on Single Canes.

Variety	Sucrose per cent. grms. Juice	Brix	Totals solids as Sucrose per cent. grms. calculated from :— RI(1)	RI(2)	RI(3)	RI(4)	RI(1), (2) and (3)
M.1722	19·09	19·96	22·5	23·2	21·7	20·9	22·5
55/74	18·77	21·33	22·3	22·5	23·6	22·0	22·8
BH.10(12)	18·72	20·52	23·2	23·7	22·8	21·4	23·2
M.2316	18·39	20·56	21·4	22·9	22·4	21·3	22·2
M.1318	18·26	20·03	21·6	23·5	22·8	21·2	22·6
M.522	18·18	19·25	20·9	21·2	20·9	20·2	21·0
R.P.6	18·10	19·96	22·8	22·0	18·9	21·1	21·2
M.1323	18·04	19·58	22·6	22·1	21·1	20.4	21·9
M.1325	17·85	19·36	21·8	22·2	21·9	20·4	21·7
M.2425	17·77	19·36	20·7	22·0	20·9	20·2	21·2
M.625	17·56	19·17	20·8	20·2	21·2	19·9	20·7
W. Tanna	17·35	19·85	23·3	23·3	22·5	21·0	23·0
M.2325	17·05	18·62	20·2	22·2	22·6	19·4	21·7
R P.8	17·02	19·18	21·7	21·8	23·2	20·3	22·2
M.1125	16·96	18·10	19·6	19·6	18·7	19·4	19·3
R.P.73	16·68	18·72	21·2	21·4	24·2	20·0	22·2
M.1625	16·63	17·64	19·3	20·3	20·8	18·7	20·1
D.109	16·59	18·67	20·7	20·8	22·1	19·8	21·2
M.925	16·53	18·40	20·5	22·2	20·9	19·0	21·2
M.2620	16·43	18·60	18·8	21·5	22·6	19·7	21·0
M.2125	16·24	18·05	17·5	17·6	19·2	18·9	18·1
M.122	16·24	17·94	19·6	20·8	21·4	19·0	20·6
M.1825	16·10	18·05	17·1	19·5	21·1	19·4	19·2
BA.11569	15·32	17·57	18·4	21·5	21·8	18·7	20·6
M.825	15·20	17·37	18·8	17·9	18·8	18·4	18·5
Bambou R.	15·08	16·94	21·2	18·5	18·9	18·0	19·6
M.1425	14·73	16·62	16·6	18·2	18·2	17·5	17·7
Uba seed	13·08	16·90	15·9	17·3	17·8	17·8	17·0
M. 1217	12·77	16·27	17·3	18·5	19·5	17·6	18·4
CO.213	8·93	14·08	13·6	13·1	13·1	15·3	13·3
CO.213			12·5	13·0	13·5		13·0

as the amount of juice obtained from the spot samples was extremely small; in some cases more than one core had to be taken to get sufficient juice to determine the refractive index. This would not seem to cause any big error, however, as all the results are likely to be rather on the high side. Furthermore, for cane seedling selection work, absolute determinations of the sucrose content are not required, but rather figures which may serve as comparison of the richness of the various seedlings.

The object of the first series of determinations was therefore to ascertain the correlation, if any, between the sucrose content as determined by polarization and the sucrose content obtained from the mean of the refractive indices of the three spot samples of juice taken from different parts of the cane. The results of these determinations were plotted one against the other, and from a consideration of the graph obtained, it is evident that there is a strong positive correlation. The coefficient of correlation for these two sets of figures was calculated, and found to be 0·893 ± 0·024. Consequently, this method of

TABLE II.

Showing Sucrose (Polarization), Brix and Sucrose calculated from the Refractive Indices of single stools of seedling canes.

Seedling No.	Sucrose per cent. grms. juice	Brix	Total solids as Sucrose per cent. grms. juice. calculated from mean of 6 R.I.'s	Total solids as Sucrose per cent. grms. juice calculated from mean of RI(1), (3) and (5)	Total solids as Sucrose per cent. grms. juice calculated from mean of RI(2) (4) and (6)
7	19·05	22·18	23·6	23·1	24·1
26	17·91	21·08	23·1	22·4	23·8
17	17·82	20·95	23·2	23·5	22·9
12	16·96	20·01	20·9	21·3	20·3
14	16·75	20·28	21·3	21·7	21·0
19	16·70	19·15	20·9	21·5	20·1
13	16·65	19·56	20·9	18·8	22·8
11	16·51	20·18	21·3	20·5	22·1
23	16·23	19·56	21·2	21·2	21·2
5	16·10	19·27	20·6	21·2	20·3
2	16·06	19·27	19·2	18·9	19·6
25	15·84	18·92	19·8	19·4	20·3
10	15·48	18·65	20·7	18·9	22·5
3	15·44	19·15	20·9	21·2	20·7
22	15·15	19·40	20·6	19·9	21·3
15	14·92	18·24	18·5	18·4	18·9
20	14·84	18·12	21·4	20·4	21·3
18	14·79	18·65	20·1	20·6	19·6
8	14·63	18·35	19·0	18·9	19·0
9	14·38	17·66	20·1	19·7	20·4
21	14·28	18·01	18·0	17·3	18·8
24	14·10	17·44	19·6	19·6	19·7
16	13·94	17·66	18·5	19·8	17·4
4	12·41	16·13	18·6	17·9	18·9
1	11·90	15·66	18·1	17·4	18·8
6	11·69	16·52	17·2	16·7	17·8
27	11·46	16·40	17·3	18·3	16·3

determining the refractive index may, with a fairly high degree of safety, be used for comparing the sucrose contents of individual canes.

In the second series, the refractive indices of six spot samples were determined, not in the expectation that it would be necessary to do so many in the field, as to enable the investigator to make various combinations. From the results obtained in the former series, it was obvious that the determination on one spot sample would give no reliable indication as to the sucrose content. Here also the sucrose content of the whole stool by polarization was plotted against that of the mean of the six *RI*'s, whilst in a third graph the sugar by polarization was plotted against that from (*a*) the mean of *RI*(1), *RI*(3) and *RI*(5), (*b*) the mean of *RI*(2), *RI*(4) and *RI*(6), i.e., two combinations, each of which includes a sample from the top, middle and bottom. Both of these

figures indicated that there is a strong positive correlation between the different sets of figures. The coefficient of correlation for the results plotted in the 2nd graph is $0{\cdot}899 \pm 0{\cdot}012$, and for those in the 3rd $0{\cdot}826 \pm 0{\cdot}015$. It is thus seen that a strong positive correlation exists in both cases, but that when the mean of six determinations of refractive indices is used as the basis for comparison, the results may be regarded with much more safety when the mean of three determinations is used.

The number of spot samples to be taken in practice may be varied as a result of the number of stools to be examined. Thus where a very large number of stools have survived the preliminary selection based on habit, vigour of growth, etc., it may be impracticable to take six borings from each stool. However, if the number to be examined has been reduced to reasonable limits, the results of this investigation show that much more reliable results will be gained by the examination of the larger number of spot samples.

The final test which may be given to any method is to try it against a standard method in actual practice. The batch of seedlings was selected, first on the basis of 8 kilos of cane per stool and 16 per cent. sucrose by weight in the juice as determined by the saccharimeter, and secondly on the basis of 8 kilos of cane per stool and 20·9 per cent. sucrose in the juice from the mean of six refractometer determinations. The seedlings selected were :

1st Method .... Nos. 2, 7, 11, 12, 14, 19, 26.
2nd Method .... Nos. 7, 11, 12, 14, 19, 26.

Thus it can be seen that both methods gave the same selection with one exception, that No. 2 was not taken by the second method. It may be noted that this seedling had very nearly the lower limit sucrose content as determined by polarization. Incidentally, much useful information may be gained of the internal structure of the cane. The pieces of cane cut out by the cork borer from the seedlings presented very great differences, sometimes even in one cane. In some cases fairly great pressure had to be exerted before any juice was expressed, the cane being of a pithy nature. In others, only a small pressure was needed to obtain sufficient juice for the determination of the refractive index.

It is concluded therefore that : (1) the Refractometer may, with advantage be used in cane seedling work, the results obtained being of a fairly high degree of reliability. That (2) the method of sampling is rapid, reliable and easy of application. And that (3) whenever possible it would be advantageous to take six borings from each stool, although an analysis of three borings is sufficient to give a fairly good indication of the sugar-producing capacity of a cane seedling.

Beet Factory for Persia.—Tenders are invited by the Persian Government for the supply of material for, and the construction of, a beet sugar factory at Keredj, near Teheran. Particulars on application to the Commercial Attache to the Persian Legation, 17, St. Helen's Place, London, E.C. 2.

Retailing White Sugar.—A British firm is producing bags made of waxed crêpe paper, which are being used as a wrapping medium for various kinds of produce and chemicals, or as an atmospheric liner for bags or casks. Bags made of this material are air-proof and damp-proof, and are made in any size or form. They are closed simply by bunching together the top, and tying it with string. Being thoroughly saturated with wax, and having the seams stuck together (not stitched), and being, moreover, tough and strong, these bags should form a satisfactory packing for many chemicals. It is suggested that they could be used as a packing for the direct retailing of plantation white sugars in sizes from 1 lb. up with the name of the producers printed thereon.

Metafiltration in the Sugar Industry.

With the overproduction of sugar throughout the world, and the consequent fierce competition in its sale, the industry is forced to turn its attention to improvements in manufacture which shall have as their result the lowering of production costs, while turning out a better quality of sugar.

It has long been established that the filtration employed in the carbonatation process is responsible for the increased yield and the better quality of sugar as compared with defecation or sulphitation, although even in the carbonatation process filtration is not carried out to its fullest extent, in that the thick-juice (syrup) in leaving the evaporators is generally turbid. Comparatively few factories re-filter their thick-juices. Defecation and sulphitation factories are gradually realizing the necessity of filtering their juices, either the whole of the thin-juice after the usual chemical treatment, or the syrup leaving the evaporators.

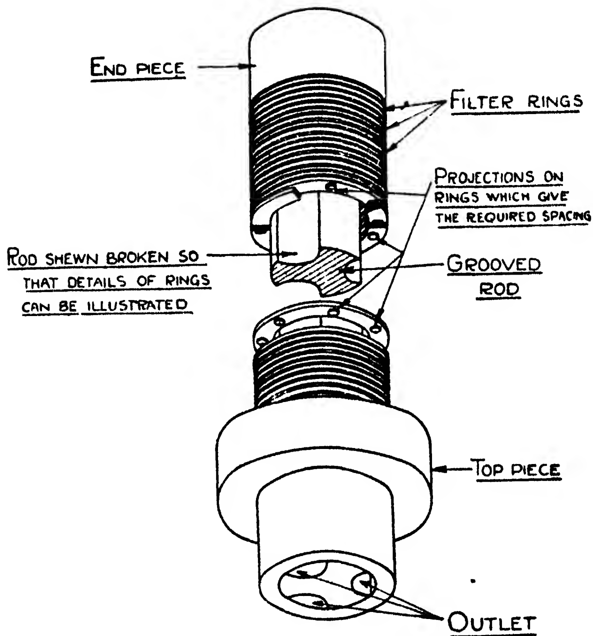


Fig 1.

This naturally implies the installation of additional filters. Before discussing the merits of the Metafilter, it might be well to point out that the cognomen of "filter" to the different types of apparatus employed seems misleading. Filtration apparatus, whether of cloth, sand, wire gauze, or rings as in the case of the Metafilter, acts simply and solely as a support to the solid matter which it retains. It is this solid matter that effects filtration, or, in other words, makes the filter bed. We have therefore to find the ideal filter bed support, one which will stand variation in pressures and will not clog. Further, such a support should be capable of permitting the flow to be reversed at high pressures to clean off the filter bed; and in all cases must ensure an even deposition of cake or filter bed.

Construction.—Judging by the design of the Metafilter recently sent for experimental trials to Gempolkrep, Java, and by the results there obtained,

the promoters of the Metafilter seem to have accomplished this. The filtering elements of the Metafilter are made up of thin brass rings $\frac{7}{8}$ in. outside diam. and $\frac{5}{8}$ in. internal diam. (see Fig. 1). The rings are piled one upon the top of the other to form a tube ; and as their thickness is about 0·031 in., a one inch run of ring filtering elements is composed of some 30 rings. Alternate rings carry light embossings on each face exactly 0·002 in. high, the intermediate ring being plain. This provides for a gap of 0·002 in. between each pair of rings. The rings are strung on a fluted rod which acts as support and provides drainage channels, the rings being compressed together by screw pressure from the end.

Any number of these filtering columns are mounted horizontal and parallel to each other in a filtering drum to which the liquid to be filtered is supplied. Filtration takes place by passing between the rings and along the drainage flutes to the outlet end. This provides a filter of the form illustrated in Fig. 2, all solid matter being deposited on the exterior of the rings. In

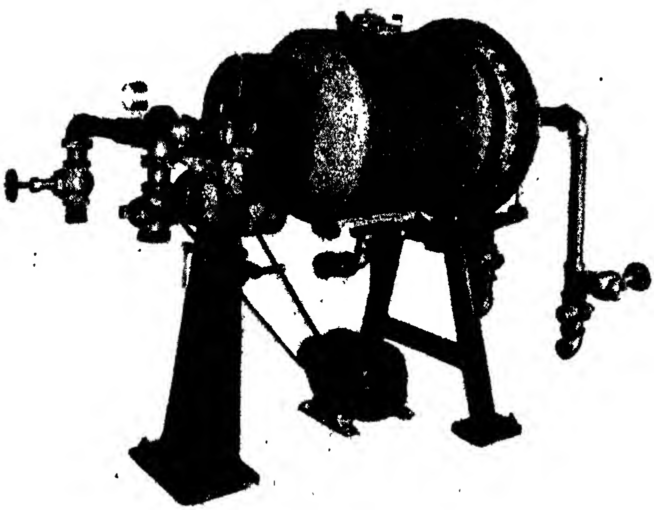


FIG 2.

actual operation it is usual to pre-coat the ring surfaces with suitable filter-beds, such as kieselguhr or vegetable charcoal.

An ingenious aspect is the arrangement to rotate the whole filter body *en bloc*. This slow rotation completely counteracts any tendency of the filter-aid to settle, so that the main disadvantage in the use of these materials is now overcome. Filter-presses, although their action is helped by the use of filter-aids, are lamentably inefficient in the utilization of such material. The necessity for maintaining filter-aids in uniform suspension has been clearly grasped for many years ; and filters have been designed with the intention of stirring up the material by revolving the filter-packs.

In practice, however, this is only satisfactory so long as a certain speed of filtration is maintained and usually speaking, the structure of the cakes is not even all over the surface of the filter unit. From the mechanical point of view the method for counteracting settling adopted in the Metafilter seems much simpler and less costly. It is undoubtedly most effective, bein

accomplished with the minimum expenditure of power without scouring action ; nor does it produce any preferential coating on any one part of the filtering surface.

Operation.—With the Metafilter, when filtering juices in a defecation or sulphitation factory, it is necessary first to pre-coat the columns of rings with thin layer of kieselguhr. This is accomplished by keeping a tank fitted with stirring gear specially for pre-coating liquor. Pre-coating takes about five minutes, after which filtration of the dirty liquor is at once started.

It was found in Java that an addition of 0·5 per cent. kieselguhr on the Brix of the heavy liquor being filtered was all that was necessary to obtain a fairly rapid flow. In other countries the amount of kieselguhr necessary may be more or less. The following extract taken from the *Archief*, 1930, No. 37, gives the actual results obtained :—" In 60 min. 1000 litres of thick-juice of 55-60° Brix. at a temperature of 70°C. were filtered, which with a filtering surface of 2·2 sq. m. corresponds to a capacity of 7·5 litres per sq. m. per min." This equals 9·3 gallons per sq. foot per hour, a very high rate. It was observed that the filtered syrup was crystal-clear.

When the rate of flow has reached the economical limit, the filter is stopped rotating, and compressed air is passed into the drum to maintain the cakes on the horizontal ring columns. The mother-liquor is drained off, then water passed through the cakes to wash out the sugar. Washing being complete, the discharge door of the filter is opened and compressed air or water passed through the reverse way. The cake falls off, immediately leaving the filter elements in as clean a condition as when new. When all the mud has been washed or blown out of the drum, the filter is again pre-coated and filtration recommenced. The whole operation of washing, discharging cake and pre-coating again only takes 18 mins., which is extraordinarily fast as compared with other types of filters.

In Java there appears to be some reluctance to the use of kieselguhr as a pre-coat, in spite of the fact that in other countries pre-coating is recognized as an efficient and economical practice in preventing the clogging of the cloths and in securing an easy discharge of cake. With the idea, however, of avoiding the use of kieselguhr altogether, experiments were conducted at the Gempolkrep s.f. with sand.

Suitably selected material (sand) was placed in the empty filter, and thick filtered syrup pumped in. When full the filter was rotated, and the syrup circulated for 7 mins. Then without stopping the rotation, or troubling to examine whether the sand had been deposited on the packs, filtration of dirty syrup was started. After running the usual two hours filtration, the filter was stopped, drained off, and the cake examined.

It was gratifying to find that a perfect bed of sand had formed on the packs with the usual cake formation on top of the sand. A very interesting feature was noticeable, in that some loose sand which had not been deposited had had a scouring or scratching action on the cake as it formed. This must have had the effect of constantly breaking up the film formation. It is a fact that an increased rate of flow was obtained in this way.

LIMING CONTROL.—" Recent investigations indicate that the H.I.C. of the limed juice is of little importance in determining the lime requirements of mill juices. The entire problem of liming must be solved by determining the amount of excess lime added during clarification in order to obtain a clear or well defecated juice. Liming is a function of the precipitable impurities, and the iso-electric point of the proteins.[1]

[1] R. H. King in *Sugar News*, 1930, 11, No. 7, 366.

Recent Work in Cane Agriculture.

Report of the Department of Science and Agriculture, Barbados, for the Year 1929-1930.

This Report is of unusual interest, as showing the way in which one of the smaller West Indian Islands, which is entirely dependent on the sugar industry, is meeting the present crisis. The late Director, J. P. d'Albuquerque resigned, in February, 1928, and R. W. R. Miller was appointed in October, 1929. The Report is largely made up of those of the Geneticist (45 pages), and the Agricultural Chemist (42 pages), with shorter ones by the Director, Entomologist and Inspector of plant diseases. The whole retains its former folio (foolscap) size and runs to 121 pages of print, with 17 Plates and seven Figures in addition. The speed with which this mass of detailed work has been completed, printed and distributed is truly remarkable. A few only of the chief points of agricultural interest to the sugar industry can be referred to here.

The Report of the Director, R. W. R. Miller.

While fully realizing the gravity of the situation in the sugar industry no time is lost in pessimism. The broad fact is referred to that the Commission sent out by Lord Passfield reported the urgent need of assistance, and that no offers of help which can effect immediate alleviation have been forthcoming. Fortunately, the larger proprietors were able to make arrangements to carry on with the crop planted at the end of 1929 ; but no remarks are made as to the future. The industry as a whole has shown itself eager to adopt any plan for cheapening the production of sugar and has taken as its motto "co-operation," as is evidenced by the readiness of the farmers to assist in the liberation of the parasite of the moth borer, already resulting in the promise of early control of this all-important cane pest.

The peasant farmer is receiving special attention, as his position has become extremely hazardous. An exhaustive Report has been presented by the Assistant Director. C. C. Skeete, whose recommendations stress the following points : The majority of peasant cultivators are not farming economically ; practically all have bought land at uneconomic prices, and have insufficient capital or none for working ; every large estate which has been broken up for sale is rapidly losing fertility, which is depleting the capital of the island ; no holdings of under five acres can be profitably worked for growing sugar cane. With these conditions, the formation of co-operative credit societies is the only obvious remedy ; but past experience makes it necessary that only a limited number should be started, till the means of their successful working is found out.

An agricultural census has been commenced, in sympathy with the world movement inaugurated by the International Agricultural Institute of Rome, for the year 1930. The tonnage of canes per acre has been studied, and the results recorded are based on 77 replies out of 107 plantations in the island. The crop is divided into early, before March 1st, middle, from then to April 5th, and late, after that date. The mean tonnages for these periods in the island were 29·4, 28·8, and 25·9 respectively ; and the general average for the whole crop is given as 28·5 tons of cane per acre. The details for the 11 parishes are given in a Table ; and the average yields of individual plantations on a map, where each plantation is represented by a circle conveniently marked to indicate crops ranging from 25 to 35 tons or beyond these limits. Two additional maps are added, giving the yields for BH 10(12) and Ba 11569, the standard canes, on the different estates. With similar records in future years, it is claimed that much information will be obtained as to the spread of

varieties and their suitability for different parts of the island. Attention is also drawn to the phenomenal success of two new seedlings, B 726 and B 891, now about to enter the commercial phase : a yield of first ratoons of the former, on 60 inches of rain, is reported as amounting to 15,000 lbs. of sugar per acre. Incidentally, the first map might be regarded as a rainfall map of the island, as yield closely follows the amount of rain falling on the plantations.

THE REPORT OF THE GENETICIST, A. E. S. McINTOSH.

The *Cane Breeding* work in this Report is dealt with more fully than in the previous year, and certain conclusions have been arrived at regarding flower opening, anther dehiscence and pollen shedding, the details of which are promised in a separate paper. Lists are given as usual of canes used as parents, and certain changes are noted here. No selfings appear to have been made, and the programme was confined to crosses between definite parents and collections made from free arrows. Of the six female parents selected in each year, four, POJ 2364, POJ 2379, Ba 11569 were repeated ; while B 381, White Transparent and POJ 2222 were replaced by B 891, Co 213 and POJ 2725. The list of uncontrolled crosses, where only the female parent is known, has been considerably expanded ; four of the seven used in the previous year have been repeated, and ten new ones added. Such changes are inherent in cane breeding work, and will continue as fresh parents suggest themselves, the seedlings retained increase in number, and more knowledge of parents and seedlings is gained. A review of these changes at any time will afford a clue as to the policy pursued during a series of years.

In the *Table of germinations* presented, B 391 appears to be the most consistently good male, while Ba 11569 is the most prolific female parent in the crosses : many of the free arrows gave masses of seedlings. The highest number of seedlings obtained among the crosses (382 per unit box) was noted in B 891 fertilized by B 391, and in the free arrows B 891 reached 416·7. BH 10(12) was not used as a female parent, and was only good as a male parent in half of the six crossings, i.e., with Ba 11569 (170), POJ 2364 (14·8) and POJ 2725 (15·7).

Although some of the caged crosses showed high germinations, those from open arrows were more abundant ; and to throw light on this difference certain factors were studied in a series of special sowings, all with fuzz from arrows used in controlled crossings. The results were, briefly, as follows. Considerable variation in germination numbers was noted in different lanterns, and these variations were considered to be due to differences in temperature and humidity. Fuzz collected early in the season gave far more germinations than after the end of November. No significant differences in germination were noted in fuzz taken from different parts of the arrow, top, bottom or middle. The optimum number of days between collecting the fuzz and sowing it appeared to lie between 5 and 9, while a delay beyond 12 days tended to a decrease in germinating capacity.

Some 16,000 of the year's seedlings were picked out from the boxes, potted up and placed in the irrigation cisterns, thus providing ample material for the selection of the 6000 seedlings subsequently, for planting out in the field. This picking out of the best seedlings from the boxes was considered to be justified from the previous year's observations. A serious attempt was made during the season to define this *growth vigour as a measureable quantity*, by fixing on certain features of the seedlings and awarding marks or points to them according to their development : such development was judged by examining 100 randomized seedlings from each batch and taking their average.

The features chosen were : number of tillers, development of tillers, length and breadth of leaves, and length and width of pseudostems—six features in all ; and, for the purpose of comparison, a standard batch was fixed upon, e.g., Ba 11569 × BH 10(12), and its growth vigour was represented by 100 points. These points were distributed among the six features, in the order given above, as 30, 20, 15, 15, 8, 12 = 100.

As an example, for comparison with the standard, the batch of POJ 2364 × B 417 seedlings is taken by the author. In feature 1, number of tillers, the average of 100 seedlings of the standard was found to be 2·61 per seedling, while for POJ 2364 × B 417 it was 2·98. The points allotted to the standard for number of tillers was 30, thus that for the POJ cross became 33·9. Taking each feature in turn for these two batches, while the Ba 11569 batch of seedlings had a measured vigour of 100, that for POJ 2364 was 114·7.

A study on these lines was made of a number of batches at four different dates, while the seedlings were still in the cisterns, and the results are given in an interesting Table. Reviewing this Table, the author draws attention to the fact that the growth vigour of seedlings, obtained by crossing Barbados and Java canes was almost invariably greater than that of seedlings obtained by crosses between Barbados parents : the extremes were 151·6 points obtained by the batch POJ 2364 × B 205, and 78·7 for a batch of Ba 11569 × B 381 seedlings. The potted seedlings for the year were planted out in the field in May 1930, under irrigation, when about four months old ; and, as in the previous year, they were placed in three groups, for early, medium and late reaping. All the seedlings of a batch were randomized over the group area which they occupied, to rule out the influence of position on any feature being studied.

Turning to the *seedlings reaped in* 1930 ; these were raised during 1928 and planted out in May 1929 in three groups according to the time of harvesting. The early group was reaped at the end of January (1930), the medium at the end of March, and the late in the second week of May. The findings of 1930 corroborated the results obtained in 1929 : they proved the efficiency of choosing the more vigorous seedlings in the cisterns, as a means of obtaining higher mean weights at crop time in the first year. Cistern selection will therefore be continued. " Incidentally, it was proved. on analysis of sucrose percentage data in seedlings from Ba 11569 × BH 10(12) and Ba 11569 × B 391 crosses, that cistern selection for vigour actually gave plants with a significantly higher sucrose percentage over non-selected . . . This point will be pursued in future, for the reverse result might have been anticipated."

The effect of several factors on the growth of the canes and the commercial value of the crop. This study largely resolves itself into: selecting five varieties, Ba 11569, BH 10(12), B 417, Ba 6032 and B 465, as representing the range of types of growth habit in Barbados ; growing these on two stations, Vaucluse and Graeme Hall, in wet and dry regions respectively ; making fortnightly observations, between February 1929 and January 1930, of the increase in length of the shoots, the new shoots formed, and the total number of shoots ; and recording the weight of the crop and quality of the juice during the cropping season.

Graphs were prepared to record the observations at each station during the year, and the following are reproduced on Plates IV to VII : rainfall, growth in length of shoots, number of new shoots, and total number of shoots, these graphs giving the means of all varieties at each station. The results obtained are discussed at great length, and summaries are given at intervals of the growth results and the changes taking place in the juice and

weight of cane, at each station. An important item in the last named is the influence of "pests and diseases," in Barbados taken as synonymous with the moth borer. Its prevalence is indicated on the graph of the total number of shoots, which is a resultant of the new shoots formed and those killed by the borer. Almost throughout, the dry station has more shoots per stool than the wet. The work will be continued and will, presumably, in due course form the subject of a separate paper.

The Report concludes with a discussion of the *variety trials, plants and first ratoons,* on plots laid down in December 1928 and reaped in 1930, at a number of stations in the wet and dry regions. The plant trials were conducted on eight estates and the ratoons on five. The percentage of sucrose in the juice, the tonnage of canes and the sucrose in lbs. per acre are shown on a series of Plates[1] of somewhat original design, by which the performance of the varieties at any station can be seen at a glance. Each station is represented by a wide vertical column, with the quantity produced by each variety extending to a certain distance upwards, and the varieties are distinguished from one another by conventional markings, so that each variety may be at once compared as to its value on each estate on the Plate. The five stations of ratoons, both wet and dry, are accommodated on the same Plates, while in the eight plant cane stations, the wet and dry are separated.

The recommendations based on these results are of course most important for the general aim of the work of the geneticist, namely the reduction in the cost of sugar production in the island. They are, briefly, as follows for the different regions in the island : Region I, with higher and prolonged rainfall : plant B 726 and BH 10(12) in about equal quantities, reaping B 726 first and then commencing with BH 10(12). Both are good germinators : B 726 has higher sucrose at the beginning of the crop than other varieties, but rots considerably after the middle reaping, and therefore may then give place to BH 10(12) which has not nearly so much rotting and has by this time reached a high sucrose content.

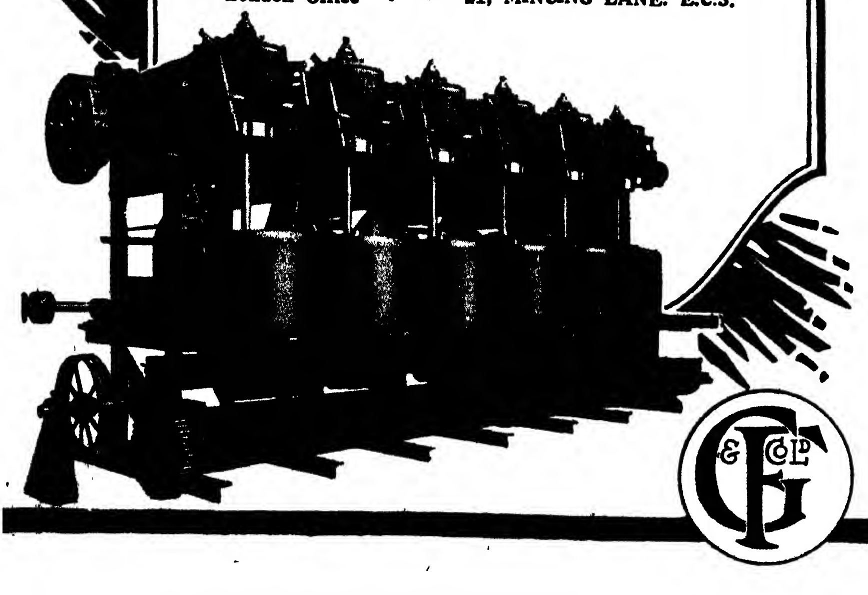
Region II, drier parishes : no variety has been found which can retain its tonnage or its optimum juice to the end of the crop in this region. B 726, B 891, B 831 and Ba 11569 are considered suitable, but Ba 11569 should be severely restricted and give place to B 891 and B 831, both of which tend to give higher tonnage and better juice, and are consistent in their performances while Ba 11569 is not. B 726 had very high quality juice and good tonnage : it retained the quality of its juice but the tonnage tended to drop.

Region III, which may be called transitional : all the varieties mentioned above may be recommended, but should be reaped in the following order, B 726, Ba 11569, B 891 or B 831, BH 10(12), one-quarter of the crop under each.

Report of the Agricultural Chemist, S. J. Saint.

There are many points of agricultural interest in this long Report, but perhaps the outstanding feature is the extremely lucid exposition of the results obtained in the manurial trials conducted. This sheds a clear light on the limiting factor of soil moisture in the cane fields of Barbados and hence the economic value of a mulch of trash in the cane fields, also on the economics under present conditions of the current applications of pen manure and other slow acting ones and of artificials generally. The plots were dupli-

1 These and other plates do not accompany the letterpress they refer to, but are scattered at intervals of a few pages throughout the Report. There may be reasons for this, but the result is confusing to the reader, and one may be excused for remarking that it is unnecessary for this "randomizing," on which the author rightly lays such stress, to be extended thus to the make up of the Report.



cated on red and black soil centres : there were nine different treatments, each replicated six times at each centre, and the plots were laid down on randomized blocks. It is interesting to note that the order of yields in the two centres was almost identical.

The detailed results are set out in a Table with the following columns : number of plot, treatment, lbs. of nutrients (N, P_2O_5, K_2O) per acre, yields of cane per acre on black soil, on red soil, and the mean, the difference of this mean from that of the no-manure plot No. 1, cost of treatment per acre, and the value of the increment at $4 per ton of canes. The main features of the results are given as follows : (1) The justification of the value put upon a mulch of trash ; (2) the demonstration of the costliness of the local applications of pen manure ; (3) the lesser value of other slow acting nitrogenous manures—cotton seed meal, compound of fish manure, sheep manure ; (4) the need for counting the cost of these and the common artificial manures used, ammonium sulphate, super-phosphate and potassium sulphate. In fact, the need for a thorough overhauling of the current manurial routine in the cane fields of the island.

Mulching with trash.—Plots 4 and 8 received 78 lbs. of N, 67 lbs. of P_2O_5, and 168 lbs. of K_2O, making 313 lbs. of nutrients per acre ; and only differed from one another in that plot No. 4 was " trashed " in January, 1929, while the canes were young and the soil was still moist from the winter rains, whereas none was applied to plot No. 8. No. 4 was more forward and greener all through, and this was specially noticeable at the end of the dry season, namely in June. At crop time this plot produced 3·7 tons of cane per acre more than the untrashed plot, which is very significant. As shown later in the Report, moisture is in Barbados a limiting factor in crop production. During the dry season high winds and hot sun prevail, conditions very favourable to loss of water from the soil. If trash is not available, it would be a profitable investment, even at present prices, to manure the sour grass pastures in order to obtain trashing material ; and if sufficient grass cannot be obtained harrowing between the young canes should be done. Later in the Report sour grass, *Andropogon pertusus*, is thus discussed : In Barbados, soil which is too shallow for sugar cane is put under sour grass. These " pastures" are at least 50 years old, and it is the practice to cut them once or twice a year, and use the grass in the off season when cane tops are not available for the cattle pens ; what is not eaten is used as litter. The pastures are not manured and the amount of grass is limited. The great need for mulching and for increasing the organic soil content suggested experiments in manuring. The results are given in a Table showing the gains obtained at the first cutting only on both red and black soils . . . . . The conclusions drawn from these experiments are : " There seems little doubt that the typical Barbados sour grass pasture will give an increased yield (in two cuttings) of between 300 and 400 per cent. as the result of judicious manuring. Sour grass pastures are rented at about $10 per acre, and since a complete dressing of manure will cost about $12 per acre, and the yield of grass when manured will be as great as was formerly given by 3-4 acres, it is obviously an economic proposition."

The addition of pen manure.—The general practice in Barbados is to apply relatively enormous dressings of pen manure, usually from 20 to 70 tons per acre. While the value of pen manure is undoubted, such quantities cannot be supported on theoretical grounds, and at present prices are uneconomic. In the pen manure plot, No. 2, about 40 tons were applied, and in plot No. 3 half that quantity with artificials added, meaning 920 and 694 lbs. of nutrients per acre respectively, against the 313 in the trashed plot No. 4. And plot

No. 4 beat the pen manure plot with artificials by 1 ton of canes per acre, and the pen manure without these by two tons. It must of course be borne in mind that pen manure is much more slow acting than artificials, and that the ratoons may benefit, and these plots will be ratooned.[1] "The best practice is to make up sufficient manure to keep the stock dry and give smaller dressings per acre. The excess of trash and sour grass can be applied direct to the land, preferably as a mulch."

Organic manures, such as cotton seed meal etc., are commonly applied if the pen manure is short. By making a mixture of artificials to equal these in nutrient value, the same result is obtained at crop time with a reduction of cost of $21 per acre. "The results show that there is no need to purchase expensive compound manures if pen manure is not available : a simple mixture of artificials is much cheaper and gives equally good returns." There is not space to go further into this matter but, as the author observes, "It is obviously not economic to supply nutrients to non-irrigated land for the production of 100 tons of cane per acre, when the water supply is only sufficient for an average of 28 tons."

Turning in conclusion to the acid test provided by the last two columns of the Table, the cost of manuring per acre, and the value of the increment at $4 per ton of cane (presumably the local figure), plots 4 and 8 alone paid. The trashing plot showed a profit of $14·8 per acre, and plot 8 a profit of $4. All of the others showed a loss : pen manure with artificials of $5·8, pen manure alone $12, cotton seed meal with potash $14·1, "fish manure" $20·2, and sheep manure $25·1. As the author puts it "Conservation of water under Barbados conditions is economically more effectual in increasing the yield of canes than an increase in the manure."

POINTS ON CANE RIPENING. **H. H. Lyman.** *Reports of the Association of Hawaiian Sugar Technologists, October*, 1930.

The author of this important paper, as intimated in the title, confines himself to certain aspects of the subject "merely bringing together points, which under certain conditions have proved helpful in this process." The number of factors influencing juice qualities is so large that generalizations are impossible ; weather, soil, altitude, variety of cane, disease, dates of planting and harvesting, irrigation, fertilization, plantation practice—some of which are controllable and some not ; while plants and ratoons, irrigated and non-irrigated, long and short crops have to be considered separately. The bulk of the paper deals with the application of nitrogenous manures, and the effect of irrigation ; nitrogen being the most important element affecting the juice, and the cessation of irrigation towards the end of the growing period having such a profound influence on ripening.

Application of nitrogenous manures to irrigated crops. (1) Long crops started *early* in the year. Irrigated plantations taken as a whole, may be divided roughly in respect of the quality of the juice, into three groups ; those which normally produce good juice, those that yield fair juices but with some difficulty, and those where only poor juice is to be expected. In the first of these groups it is customary to give approximately three-fifths of the nitrogenous manure in the first year and two-fifths in the second, in the next group four-fifths and one-fifth, and in the third group all in the first year ; the total amounts being 250 lb. N in the first two groups and 200 in the last.

[1] The value of pen manure must not be judged solely by the action of the nutrients contained in it, either in the succeeding plant crop or in the ratoons. Its chief value lies in the amelioration of the soil and its water storing qualities ; and the effect of heavy dressings should continue for several crops and not only for plants and first ratoons

The tendency seems to be to apply, in the first year, the greater proportion in the warm months, i.e., the " boom " period of the young canes, and to cut it down in the late fall and winter, both for eye spot control and as saving this expensive manure. The second season applications are limited to the amount of nitrogen which will be exhausted just before ripening begins. This depletion of nitrogen in the soil is a material factor in the cessation of growth when the winter rains descend upon the ripening crop. There is a growing feeling that any further increase that may be made in the amount of nitrogenous manure should be made in the first year, provided that the amount normally required in the second year has been determined.

(2) In *later* started long crops (i.e. in midsummer or fall), the tendency is to cut down applications during the first year. Several planters systematically decrease their first year applications, as the season of planting becomes later, month by month ; then giving additional nitrogen in the following spring to make up the total. If, however, the planting has been done very late a reduction is made in the total applied to the crop. Ripening is much simpler in late planted fields, because the harvest is in late spring or in summer, when the general conditions for ripening are much more favourable, i.e., when a more complete exhaustion of the nitrogen in the soil can be effected, and there is less rain.

(3) Several planters advocate *splitting* the second season applications both in early and late planted long crops, not only to avoid subsequent burning, but as giving a better distribution in the field. Also, in late planted fields because the final dose may be withheld till the proper interval is reached between it and the harvest. A Table illustrates this important point, as reported from Pioneer plantation for the 1929 crop. This Table records the crops reaped in nine field experiments, in each of which the second year's nitrogen was applied in one and in two doses. In five of these experiments the amount given was 87·2 lbs. N and in four 125·9 lbs. Excepting in one case with 125·9 lbs. all of the results point in the same direction ; and the averages are here given.

87·2 lbs. of N in one dose : tons cane p.a.	80·8,	Q.R. 7·40,	tons sugar p.a. 10·91
ditto two doses :	84·6,	7·46	11·36
125 lbs. of N in one dose :	81·8,	7·56,	10·81
ditto two doses :	85·9,	7·54,	11·41

(4) The interval between the last application of nitrogen and the harvest is dependent on too many conditions to be dealt with, especially as these conditions are so variable. A note on the effect of the physical structure of the soil is however given from three plantations, two in Kauai and one in Oahu. Data are available for the following types of soil on these plantations : " poorly drained high water table, adequately drained loam, very porous sandy." As might be expected, the interval increases as the soil drainage becomes more difficult, and it is recommended that this study should receive further attention.

Unirrigated long crops.—The chief characteristic of these, as compared with the foregoing examples of irrigated crops, is the much greater variation in the practices of applying the nitrogen ; and to all appearance this is due to less attention having been paid to the subject. As an example, the method of application to early planted canes is given in four contiguous plantations, where the cane is growing under similar conditions : the first plantation gives more nitrogen in the second season than in the first, the next one applies all its nitrogen in the first year, the third gives half in each season, and the fourth does as in the second plantation and gives all its nitrogen in the first year.

For the late planted fields, only two out of the nine reporting show any difference in application from that in the early planted fields on the same plantations.

The effect of phosphoric acid and potash on juices.—Very little information is available and only two replies are referred to. Oahu Sugar Company reports : " There is every indication that the best yields and best juices result from applying the three major plant nutrients with each application, that is, a mixed fertilizer used throughout the crop gives the best results in every way." Ewa Plantation Company reports that potash favourably influences juice qualities, while phosphoric acid may possibly tend very slightly to depress them. A long Table of harvests and plot experiments is given in support of these conclusions. Only the potash results are of interest Taking the three qualities of juice, Brix, polarization and quality ratio together, we get 339 results for the 113 harvests studied ; and of these 103 gave significant gains with the application of potash, 229 neither gains nor losses, and only 7 significant losses. For phosphoric acid, in 96 harvests, the figures were respectively 17, 245 and 26.

As regards irrigation, a diminution towards harvest is obviously of advantage, and this may take the form of a gradual lengthening of the intervals between waterings or a sudden cessation of all irrigation, according to circumstances. There is not space to deal with the conclusions arrived at ; but there appears to be a danger in some plantations of ceasing to irrigate too long before the harvest. Unduly prolonged periods " under average conditions not only cause loss of tonnage and poorer juice, but loss in stand and vitality of the ratoon crops, and it may even prove profitable to sacrifice juice to a small extent in order to retain this vitality " which is of fundamental importance in the succeeding crops.

C. A. B.

Some Remarks about Condenser Plants.[1]

By Prof. E. C. VON PRITZELWITZ VAN DER HORST.

All the condenser plants in use in this country use water-injection. According to the method of removal of water and air, there are the following different types : (1) The barometric condenser, with water-discharge through a tail-pipe of over 10 metres height and air-removal by a dry-air pump. In this case the injection-water is generally supplied by a centrifugal pump. (2) The " Werskpoor " condenser : a peculiar arrangement, in which the tail-piece of the piston-rod of a vertical steam-engine drives the dry-air pump, which is placed at the top of the condenser (actually built into the condenser). The condenser is placed at a moderate height (about 5 m.) ; therefore the injection water is drawn into the condenser by the vacuum without the aid of a pump, and the waste-water is removed by a centrifugal pump, placed on the end of the crankshaft. And (3) low-situated injection condensers, directly connected with wet air pumps, which remove air and waste-water together. Injection-water, as in the former case, is drawn in by the vacuum, without the aid of a pump.

As regards the application of these three systems, the following can be stated : (1) The barometric condensers are by far the most common, and in the vast majority of cases they serve as central condenser-plant for the whole factory. There are four mills in Java, however, which have two such plants which makes it possible for them to use one for the evaporator alone and the

[1] Paper read before the Third Congress of the International Society of Sugar Cane Technologists, Java.

other solely for the boiling-house. (2) The Werkspoor condensers are used in eleven sugar mills as a central condensing plant, only one of the eleven having two such plants. (3) The injection condensers with wet-air pumps are not used as central condensers, there being always several in each factory, for one (or more) boiling pans or for the evaporator. This system is more or less obsolete, and is found in only 12 mills.

As regards dimensions, I deal only with the capacity of the air and injection water pumps, giving figures based on a daily grinding capacity of 1000 tons of cane. For Group 1*a* (one central barometric condenser for the whole factory) we find as the average for 138 plants a piston displacement of the dry-air pump of 7·31 cub. metres per min. and a water-delivery of the injection water pump of 1·21 cub. metre per min. For the four cases of Group 1*b* (two separate barometric condensers for the evaporator and for the boiling pans) the figures are as follows :—

	Cu. m/min.		Cu. m/min.
Dry-air pump evaporator	3·15	Injection-water pump evaporator	0·47
,, ,, boiling-house ..	3·82	,, ,, boiling-house	0·58
Total	6·97	Total	1·05

For the 11 cases of Group 2 (Werkspoor condensers) the averages are : Dry-air pump, 8·08 cu.m./min.; Waste-water pump, 1·35 cu.m./min. Finally, for the 12 cases of Group 3 (wet-air pumps) : Wet-air pump evaporator, 3·05 cu.m./min. ; Wet-air pumps boiling-house, 7·05 cu.m./min.

What is striking here is the smaller pumping-volume for the evaporator, despite the fact that about one-fifth of it is taken up by the waste-water that is carried off. That probably is due to the age of the plants in question and the gradual extension of the factories. The much larger total pumping volume for the boiling-house is explained by the fact that all pumps are not working simultaneously.

The averages for the remaining groups agree fairly well. And yet the high degree of arbitrariness in the dimensions in question shows in the great amount of divergence between the various cases, which is, of course, most noticeable in the large group which I have called 1*a*. Minimum and maximum measurements, respectively, are as follows here : dry-air pump, 3 and 11 cu.m./min. ; injection water pump 0·5 and 2 cu.m./min.

This great divergence also will be due mainly to the gradual increase of capacity in the factories, the same condenser-plant being retained in many cases ; at any rate, the principles on which, in case of new structures in this country, the air-pump displacement is being calculated do not so far as I know show such great divergence as one might be led to suppose from the figures I have given above.

The formula of Weiss,[1] commonly used here, for the volume A (in cu.m/min. with atmospheric pressure) of the air (or incondensible gases) to be removed is as follows :

$$A = \frac{1}{1000}\,(0{\cdot}02W + 8V)$$

where W = the quantity of injection-water in kilos per min., and V = vapour to be condensed in kilos per min.

If n represents the number of kilos of water necessary for the condensation of 1 kilo of vapour, the formula can also be put as follows :

$$A = \frac{W}{1000}\,(0{\cdot}02 + \frac{8}{n})$$

1 Weiss, *Die Kondensation*, P 35-37. (Julius Springer, Berlin.) 1910.

Taking an average value for n of 50 we get :

$$A = \frac{W}{1000}(0{\cdot}02 + 0{\cdot}16) = \frac{0{\cdot}18W}{1000}$$

Since W is expressed in kilos, which for water is practically the same as in litres, and A in cubic metres, this means briefly that in average circumstances, the volume of air (with atmospheric pressure) may be put at about 18 per cent. of the volume of injection water. The formula shows at the same time that the volume of air that enters with the injection water (in solution) is only one-eighth (0·02 against 0·16) of the volume that is to be attributed to leakages of air, air in the thin-juice and incondensible gases. Since it is these very volumes last-mentioned, that by their nature will differ very greatly in different factories and there is little positive knowledge about them, it is not greatly to be wondered at that in practice the factories appear to be able to do with very widely divergent air-pump measurements.

HAUSBRAND[1] calculates for the air volume simply 20 per cent. of the volume of injection water, a figure adopted already by OVERTOP,[2] which is, for average conditions, a little more than what WEISS gives. That corresponds with our experience that WEISS' formula, which after all is derived from European practice, gives rather too small air-pump volumes and may be better put as follows :—

$$A = \frac{1}{1000}(0{\cdot}02W \times 12V).$$

Strange to say, all formulae that I have found in English and American treatises give considerably smaller volumes even than the original Weiss formula for the air carried by the vapours from the evaporator.

To avoid confusion, it is far better, I think, to calculate with weight ratios than volume ratios. WEISS does so in fact by stating the volume of air A for atmospheric pressure. As the specific gravity for atmospheric pressure and a normal (European) temperature is about 1·2 kg. per cub. metre, the expression : air-weight A, found by the original formula, must be multiplied by 1·2 giving :—

$$A' = \frac{1{\cdot}2}{1000}(0{\cdot}02\,W + 8\,V).$$

As I have said before, the term $8V$ only refers to the air present in V kilos of vapour, and we thus find :—

$$A'' = \frac{1{\cdot}2 \times 8}{1000}\,V \cong \frac{V}{100} \text{ or 1 per cent. by weight on vapour.}$$

On the other hand, BADGER[3] takes 0·2 per cent. air by volume in the vapours in the evaporator. The specific gravity of air for equal pressure is roughly double that of water vapour, so that 0·2 per cent. air by volume is equivalent to 0·4 per cent. air by weight. This figure of BADGER's is thus less than half of that given by WEISS, and even the latter is often found too low by us. Somewhat higher is the figure given by COXON,[4] 0·25 to 0·35 per cent. by volume on the vapours for cane sugar evaporators, equal to about 0·5 to 0·7 by weight.

Finally, let me cite the following figures calculated from data given by CORNER[5] for air entering in vapours from the evaporator :—

---

1 E. HAUSBRAND : "Evaporating, Condensing and Cooling Apparatus." P. 340. Third Edition. (Scott Greenwood & Son, London.) 1919.

2 *Archief*, 1901, 125.

3 "Heat Transfer and Evaporation" (1926) p. 225.

4 *I.S.J.*, 1917, 19.

5 *Engineering*, 1902, p. 74-5. *I.S.J.*, 1920, 447.

single	effet	0·28 per cent. by volume	($\cong$ 0·56 per cent. by weight)
double	,,	0·29 ,, ,,	(,, 0·58 ,, ,,)
triple	,,	0·30 ,, ,,	(,, 0·60 ,, ,,)
quadruple	,,	0·37 ,, ,,	(,, 0·74 ,, ,,)
quintuple	,,	0·39 ,, ,,	(,, 0·78 ,, ,,)

It is remarkable that this writer also gives a much higher figure than the usual one for air entering in cooling water, viz., 0·1 kg. air per 1000 kg. of water. Since 0·1 kg. of air under atmospheric pressure has a volume of about 800 litres, this would correspond to 8 per cent. of air by volume in cooling water. As only about 2 per cent. can be in solution the remainder must be drawn in the form of air-bubbles. It seems to me that that might well be avoided with proper precautions. The wide divergence of the figures I have cited for the calculation of the volume of air to be expected, indicates that there is a field of enquiry still open here.

Just a word in closing about the more recent developments in the sphere of condenser plants, about which, however, there is not much to be said so far as Java practice goes. Several mills have in recent years resorted to separate dry-air pumps (generally of rotatory type for direct coupling with electro-motors) for the evacuation of the boiling pans before these are connected with the central condenser. That makes for much greater uniformity in the working of the latter.

I have said that the plants still using separate wet air pumps for the different boiling-pans are generally obsolete. It is all the more remarkable, therefore, that we find as the most recent development a few mills resorting this season to separate condensation for one or more boiling pans, however using small barometric condensers. One factory has installed three of them, each with its own electrically driven dry-air pump and injection water pump, while in another, where for the present only one boiling-pan has its own barometric condenser, the air-suction is effected by SCHÜTTE and KÖRTING's multi-jet system. The injection-water is shot in under slight over-pressure in a set of jets, so that air and waste-water are carried off together through the barometric tail-pipe.

One difficulty about the central condensation for the boiling house is the mutual effect of the vacuum in the different pans ; the high vacuum desired during the completion of boiling in one pan is temporarily destroyed by the large quantities of vapour and air or incondensible gases, which are released from another newly connected pan. That difficulty can be avoided by applying separate condensers, which moreover automatically produce a higher vacuum during the completion of boiling according as the quantity of vapour to be condensed decreases.

The attraction of the multi-jet condensers is that they render it possible to secure this advantage without a complicated installation, because no air-pumps are necessary and one injection-water pump can serve several condensers simultaneously. The plant that is to be used this season in Java will be tried by the Experiment Station, special attention being paid to the water-consumption, because jet-condensers generally have a high water-consumption which can in many cases have a restricting effect upon its general application.

We know that elsewhere, too, (e.g. in Cuba) there is again an increasing use of separate condensers for all boiling-pans. But it seems that in most cases one dry air pump is used simultaneously for all the condensers, and that, I think, largely does away with the chief advantage of this system for the boiling house, at any rate in the manufacture of white sugar. This system is not to be found in Java.

Beet Agricultural Notes.

FINANCIAL RESULTS OF BEET GROWING.

C. BURGESS and P. E. GRAVES now publish the third and final report on an investigation into the financial results of beet growing in the U.K. during 1927, 1928, and 1929, their previous reports having already been dealt with here.[1] It is hoped that this Report and its two predecessors will assist in clarifying the economic position of sugar-beet production from the point of view of the grower.

It says in summarizing the position: "There are given ample reasons for believing that, over a number of years, growers can deliver roots to the factories at a total cost of approximately 48s. per ton, and that, when consideration is given to the residual values of the crop and the value of the tops, the net cost is somewhere in the neighbourhood of 40s. per ton. (These figures are possibly below the true average for the Eastern Counties, for the sample on which they are based may represent farmers who are most efficient and enterprising than the normal). During the last five years the sugar content of the beet grown in England and Wales has averaged 17·0 per cent., and assuming that the data given in this Report are representative, it would appear that the minimum price at which such beet could be grown without leaving either interest or profit to the grower, is 40s per ton. To the industrialist it may seem absurd to suggest that sugar-beet would be grown without the inducement of profit, but agriculture follows laws of its own. Nevertheless, 40s. per ton of beet of 17·0 per cent. sugar is surely the minimum price that could be accepted, and such a figure would undoubtedly reduce considerably the present area under beet. Further, unless improvements in the efficiency of beet production are effected, this minimum figure cannot be regarded as a safe one on which to establish a permanent industry. Lastly, without sympathetic political interference, the industry must look forward to the complete withdrawal of State assistance in three years' time, and it is then, and not now, that the minimum contract price for roots should be reached.

"On the present scale of payment for sugar content, 40s. per ton of beet of 17·0 per cent. sugar is equivalent to 35s. 4d. per ton at 15·5 per cent. sugar, but a careful study of the results emerging from this investigation suggests that perhaps the present bonus basis is not the best that could be devised. Table IV in Appendix E shows that during the three years 1927-29 fenland growers have made an average cash profit of nearly £7 per acre, while the best of the upland soil classes have averaged only £2. 10s. 0d. per acre. There can be no doubt that the special circumstances surrounding fen farming justify a claim to a higher profit than can be demanded by the majority of upland farmers, but these figures seem disproportionate. Fen farmers certainly contribute a very substantial proportion of the beet grown, but the majority of factories must still look for the greater part of their supplies of beet from upland growers, and a more even distribution of receipts would encourage the latter and larger class.

"The circumstances surrounding the economics of sugar production by the factories are less clear than those relating to beet production by the growers. In compliance with the 1924 (Subsidy) Act, through which they receive Government assistance, the factories publish their balance sheets each year, and the information thus made available is slightly amplified at the annual general meetings of each company. But these statements tell little

[1] *I. S. J.*, 1928, 496; and 1929, 506.

of the internal economy of manufacture, and their sparseness caused the Financial Editor of *The Times* recently to complain that 'it would be more satisfactory if the companies showed more clearly how the results are arrived at, and to what extent higher efficiency may have contributed to the profits.' Substantial profit distribution and increased allocations to reserves have been generally recorded, and are the main facts upon which opinions, in the absence of further information, must be based. These are, however, at best rough and unsatisfactory indications, and only make it possible to say, for instance, that the two largest factories have, during the last two years, recorded a net profit of some £5. 5s. 0d. per acre of beet worked. Undoubtedly the factories could withstand a substantial reduction in this figure and probably, also, depreciation allowances are not at a minimum, but sufficient material is not available to enable any accurate calculation to be made. It is as much in the interests of the factory to offer a price which will maintain the acreage of beet at a maximum, as it is in the interests of the farmer to maintain production at a level which will make possible economic factory operation, for only thus can the maximum contract price be obtained."

Spacing of Sugar Beet.

W. Morley Davies, Advisory Chemist, West Midland Province, has studied during 1927-28-29 the effect of one cultural factor, the spacing of the plants, on the yield and sugar content of beet grown on or near the Harper Adams College Farm (N.E. Shropshire). His conclusions are summarized as follows :—

(1) The evidence of the three years' experiments shows a very decided advantage in favour of narrow spacing of the rows It seems that expectation of consistently high yields can only be realized by narrow spacing. (2) The results do not show any significant differences in the yields of roots grown on different spacings in the row. Just as high a yield is obtained with 10 in. as with any smaller spacing. Above 10 in. the yield shows a decrease. (3) The effect of variation in the number of plants per acre (otherwise expressed as area per plant) has no corresponding response in yield or sugar content. Almost equal yields were obtained when the number of plants was small as when it was large. A spacing of 18 in. × 9 in. seems suitable for Midland conditions. (4) On fields where the soil has no tendency to form hard lower layers, the necessity for sub-soiling was not apparent. The crop, however, is one for which deep cultivation is essential.

(5) Yields of beet grown on the ridge and flat in 1927 showed an advantage in favour of growing on the ridge. Possible the greater risk of insect attack may over-ride such advantages and make growing on the flat preferable. (6) The yield of crowns bears no relation to spacing. (7) The yield of tops shows a definite relationship with spacing. Significant differences in yield were apparent in 1928 with varying spacing in the row but not between the rows. This is in the opposite direction to the results stated above for the variation in yield of roots. (8) Meteorological conditions undoubtedly play an important part in control of yield and sugar content. (9) No general relationship between sugar content and spacing is evident. (10) Under the existing agreements with the factories, most growers are advised to try to obtain a higher tonnage rather than a higher sugar content. This advice may need some modification for growers living a great distance from the factory.

Beet Factory Technical Notes.

Evaporator Incrustation.—At a recent meeting of the Association of German Sugar Technologists at Breslau, there was a good discussion on this question. Dr. H. Heubel said that the best way to collect the scale, seeing that it is generally so difficult to detach average samples from the tubes, is to suspend in them small copper plates, allowing the incrustation to deposit on these. He had found the amount of deposition in each body to be variable according to the height. Thus 45 per cent. was to be found in the top third of the tubes of the 3rd body, and 50 per cent. in the top quarter of the 4th body with only 6 per cent. in the lowest quarter. Further, he had noticed that during the past two years the composition of the scale has been different from what it formerly was. To-day, calcium carbonate is almost entirely absent, this being the result of good work at the 2nd carbonatation. Calcium oxalate and silicate now predominate, the former being especially evident in the 3rd body. It originates during boiling from the decomposition of calcium glyoxylate; and glyoxylic acid is present in unripe roots, as well as in those more or less deteriorated. Silicate, of course, arises from the use of limestone containing this impurity.[1] Dr. O. Spengler mentioned that calcium silicate could be removed from the tubes by boiling out with a solution of soda more concentrated than usually employed, and afterwards brushing. In place of 1 per cent. soda solution and 24-36 hours' boiling, he recommended a concentration of 8-10 per cent., when only 1-2 hours were necessary to soften the scale and detach it easily from the tubes. Means for the prevention of scale formation, he said, are known, but are not practicable so far. For example, if the interior of a tube be given a coating of mercury, it does not incrust, but on the other hand the metal soon becomes brittle. Here is a problem for the metallurgist, he remarked.

Sandera's Ash Apparatus.—Reichert[2] and Foth[3] appear to have been the first to propose the use of the electrometric method for determining the ash of sugar products, though Main[4] and Lange[5] demonstrated the ash content of sugar factory and refinery products to be directly proportional to their electrical conductivity. Since the war a number of workers have studied the matter, and it is now surely established that the conductivity method is rapid, exact, economical and otherwise entirely suited to the requirements of routine work. Dr. K. Sandera[6] now describes an apparatus invented by him which he claims to give satisfactory results, though it departs somewhat from conventional design. He uses a circuit of four resistances, two of which are formed by electric lamps, the third by a column of the liquid under examination between electrodes, and the fourth by a constant resistance. The lamps are so arranged that their light is reflected into a device by which the intensity of each can be compared. In making a measurement, a.c. of 120 or 240 volts is passed through the circuit. By modifying the height of the column of the liquid between the two electrodes its resistance is changed until it is equal to that of the constant resistance; then the circuit is in equilibrium, and the two lamps show the same intensity. The resistance of the column of liquid being proportional to its height a scale indicates directly the ash content of the liquid, a 26 per cent. solution of the product having been used. Apparatus operating in the manner outlined above is said to be as exact as when using telephonic indication, which is suggested to be unsuitable on account of the noise of the laboratory.

---

1 See also *I.S.J.*, 1930, 582.

2 *Zeitsch. Ver. deut. Zuckerind.*, 1889, 432. 3 *Ibid.*, p. 712. 4 *I.S.J.*, 1909, 334-339. 5 *Zeitsch. Ver. deut. Zuckrind.*, 1910, 359. 6 *Bull. Assoc. Chim. Sucr. Dist.*, *France*, 1903, 47, No. 11, 446-449.

Beet Factory Technical Notes.

Determination of R.S.—Potassium ferricyanide in boiling alkaline solution is transformed by reducing sugars into the ferrocyanide compound, a reaction which can serve as the basis of an analytical method, as STAHLSCHMIDT,[1] SOSTMANN,[2] and TARUGGI and MISCHITTI[3] have pointed out, though, as MAQUENNE has mentioned in his book,[4] details do not appear to have been precisely worked out. This method, however, has now been studied by R. HAMY, of the Institut National Agronomique of France,[5] who gives the following *modus operandi*, based on work done by JONESCU and VARCOLICI[6]: Dissolve 46 grms. of potassium ferricyanide and the same quantity of potassium hydroxide in water, making up the solution to 1000 c.c. Then 10 c.c. of this reagent plus 20 c.c. of water are heated to boiling-point in an Erlenmeyer flask, and the solution of sugar under examination (containing about 0·5 per cent. of reducing sugars) run in from a burette drop by drop, boiling being continued until the decolorization of the liquid is complete. Since with coloured solutions the detection of the end-point is obscured, one adds to the flask previous to the titration 10 drops of a 1 per cent. solution of picric acid to serve as indicator, which causes the yellow colour suddenly to change to cherry-red, at the point when the slightest excess of reducing sugars transforms the picric into picramic acid. This method is said to give exact results so long as one works with solutions containing between 0·5 and 1 per cent. of reducing sugars, 10 c.c. of the reagent (which of course should be carefully standardized using pure sugar solutions) corresponding to 0·05 grm. of dextrose, or to 0·0491 grm. of invert sugar. A great point about the process is that the reagent (contrary to Fehling's solution) is unaffected by sucrose. It would seem of interest for others to examine the value of this method, which would appear to be simple, exact, and adapted for routine work in the sugar factory laboratory.

Beet Industry Problems.—Subjects for investigations which have been suggested by the Society of German Sugar Technologists[7] are given below. Later the results of researches on these problems may be published, and contributors may be awarded prizes. (1) Comparison of the mark, content of roots worked in the factory with that mark content of the exhausted slices obtained, calculated per 100 beets. (2) Effect of removing " bolters " in July, August or September on the weight of the neighbouring roots ; and the possibility of utilizing the bolted roots themselves. (3) Sugar loss which arises during the preservation of the roots without regard to their moisture content : and, on the other hand, the losses which arise when the water is regulated (as by spraying with water, or by introducing moist air into the silo). (4) Whether in cleaning the slicing knives compressed air is as good as steam. (5) Determination of the sugar loss in flume and wash waters. (6) Effects of a more thorough exhaustion on liming, carbonatation and press work in view of the present-day improved slices. (7) Using lime of 99 per cent. CaO, the relative advantages of wet and dry defecation. (8) Factors influencing the life of filter-press cloths, especially those used in the 1st carbonatation. (9) Quantity of water necessary for the sweetening-off of the scum presses in order to wash as far as possible. (10) Influence of running turbid juice from the scum presses on the purity and colour subsequently, particularly on the quality (affinability) of the sugar obtained. (11) Whether disadvantages arise when the unwashed 2nd carbonatation scums, mixed with thin-juice, are

---

1 *Berichte*, **1**, 141. 2 *Zeitsch. Ver. Rübenzuckerind.*, **22**, 170. 3 *Gazetta chimica italiana*, **27**, 384-387. 4 "Les Sucres et ses principaux derives." 5 *Bull. Assoc. chim. sucr. dist. France*, 1930, **47**, No. 10. 6 *Bull Soc. chim. Romania*, 1920, **2**, 38. 7 *Centr. Zuckerind.*, 1930, **38**, 886-887.

returned to the 1st carbonatation. (12) Effect of varying the amount of SO_2 used on boiling and crystallization. (13) How much SO_2 added to the thin-juice reaches the molasses in the form of sulphites. (14) Coloration during evaporation and boiling. (15) Sugar loss by entrainment in the different vessels of the evaporator. (16) Results of using superheated steam on the efficiency of evaporation, and on the colour of the juices, syrups, and sugars. (17) Advantages and disadvantages of plunger and centrifugal pumps on the filtrability of the scums. (18) Whether the vapours and gases evolved during slice drying and carbonatation are capable of being utilized.

Sugar in Cossettes.—French chemists have for long closely studied the difficult question of the presence of dextro-rotatory non-sugars in the beet and their effect on the calculation of the sugar recovery. During the 1929-30 campaign, for example, J. ZAMERON[1] made careful observations worth noting of the differences occurring between the sucrose as found by the direct and double polarizations of the cossettes, these being the average of 32 determinations : Direct polarization, 15·03 ; Creydt-Herzfeld double polarization, 14·19, Clerget double polarization, 14·36, and Saillard double polarization, 14·47 ; so that between the direct polarization and the average of the three double polarization methods applied there was a difference of 0·69, due to the so-called dextro-rotatory non-sugars. But using the alcohol digestion method the polarization of the cossettes was practically equal to that given by the aqueous digestion method. Such exaggerated differences between direct and double polarizations are to be attributed partly to the presence of raffinose, and perhaps partly also to nitrogenous substances. As the result of work done by LOISEAU and others, the presence of raffinose in the sugar-beet has become certain. Its amount there depends on several factors contributing to its formation, and in the case of the figures cited above the differences may be due to the climatic conditions of the dry year of 1929. That these differences really indicate the presence of substances interfering with the direct polarization is said by the author to have been confirmed by his recovery calculations. He uses a recovery figure calculated from the sucrose in the cossettes by alcohol digestion, and this figure generally corresponds to the actual sugar weighed. At the end, however, of the 1929-30 campaign there was a difference in the sugar entering the store corresponding to the difference observed between the direct and double polarization determinations.

MISCELLANEOUS.

Diffusion Disinfectant.—An efficient preparation for preventing fermentation during diffusion is really required, and lately a French medium "Lystonol" claiming to be such has appeared on the market. It has been the subject of favourable notices, and has been well advertised. Its makers state it to be "a mixture of alkaline chlorides and of divers exotic plants submitted to ultra-violet rays giving trioxymethylene." On submitting it to analysis, J. ZALESKI,[2] however, finds it to consist mostly of zinc chloride (8·03 per cent.) and sodium chloride (17·07 per cent.), and concludes that it is to be doubted whether so small a dose as 0·002 to 0·004 per cent. (as recommended) would prevent the development of micro-organisms during diffusion. *Density of Beet Factory Pulp.*—Density values were obtained by F. KRYZ[3] for the two kinds of pulp which are obtained in the beet factory process : (1) Pulp from the screens as separated from the beet juice, washed and air-dried, its average density being 1·060, and after drying at 105°C., 1·245.

[1] *Bull. Assoc. Chim. Sucr.*, 1930, **47**, No. 6, 247-251. [2] *Gazeta Cukrownicza*, 1930, **66**, 653-655. [3] *Zeitsch Zuckerind. Czechoslov.*, 1930, **55**, 128-129.

One litre of the air-dried pulp was found to weigh 279 grms. Yield of the dry pulp was 17·37 per cent. (2) Diffusion pulp from the presses (pol. 44·5°) after washing and air-drying to a dry substance content of 5·95 per cent., density 0·985, and grms. per litre 677·2. This same after drying at 105°C., density, 1·023, and weight, 123·9 grms. per litre. Density determinations were made with a pycnometer, using petroleum. *Alcohols from Pulp.*—In a Czecho factory working unsound roots, the Experiment Station at Prague had in 1926 detected the presence of ethyl and methyl alcohols in the condensed waters from the evaporators. Since these alcohols in small amounts are known to induce the rusting of iron, it seemed of interest to M. Jedlicka[1] to ascertain whether they are likely to be formed in normal operation. On distilling 100 kg. of beet pulp with water, and repeatedly rectifying the the distillate, it was possible to detect the presence of 52·8 grms. of ethyl and 21·7 grms. of methyl alcohol. It is explained that the ethyl alcohol may be a product of the intercellular respiration of the root, while the methyl alcohol would doubtless result from the decomposition of the pectin. *Harmful Effects of Magnesia.* - E. Saillard[2] points out that the presence of magnesia in the lime used for defecation in the beet factory leads to scale formation in the evaporators, especially in the first body, though also sometimes in the second. Since the solubility of magnesia in limed juice increases as the alkalinity decreases, it is advisable when obliged to work with lime containing this impurity to omit adding any lime before the second carbonatation, adding it all before the first. Another objection to the presence of much magnesia in the lime is that in the form of magnesium carbonate and lactate it greatly impedes the filtration of the scums. *Filter-cloth Rotting.*—After a few days only the cloth used in a Sweetland used for the filtration of the first carbonatation juice commenced to tear and soon came to have about as much resistance as paper.[3] At first nothing abnormal could be noticed in the course of manufacture, and the reason of the trouble could not be suggested. It was not due to the superheated steam being used for the scouring of the cloth; and the lime was of high purity. After a time it was noticed that the water taken from a stream used for diffusion contained appreciable quantities of sulphides which passed into the raw juice. Sulphides are known to deteriorate cloth rapidly. On treating such water before use with chlorine by means of automatic dosers, the sulphides were oxidized, and the rotting of the cloths immediately stopped.

Dorr Clarifier.[4]—Whether the juice be charged with carbon dust from burnt cane, with earth, or with fine fibre, whether coarse or fine screened, it delivers clean juice in accordance with proper liming. It speeds up grinding and saves space. It sends hot juice to the evaporators at a temperature near the boiling point. It requires the services of only one man, even in the largest mills. It saves fuel.

Maxwell Crusher-Shredders.—The two articles which appeared in our October and November issues giving the results of official investigations into the working of Maxwell Crusher-shredders in Java,[5] have now been reprinted in pamphlet form, with the addition of a short note explaining a number of the Terms used by the Java authorities in their comparative data, which terms are not as well known in other sugar countries as they should be. There is also a List of prices for the different sizes of shredder offered. Copies of this pamphlet can be obtained from the patentee, Francis Maxwell, D.Sc., 334-5 Abbey House, Westminster, London, S.W.1., or from Messrs. George Fletcher & Co., Ltd., Masson Works, Derby.

1 *Zeitsch. Zuckerind. Czechoslov.*, 1929, 53, 293. 2 *Suppl. Circ. hebd.*, No. 2179.
3 *La Sucrerie Belge*, 1930, 50, 43-41. 4 From a recent advertisement.
5 *I.S.J.*, 1930, 526-30; 578-9.

Publications Received.

Report of the Water Pollution Research Board, 1929. Sir Robert Robertson, K.B.E., F.R.S. (Department of Scientific and Industrial Research; H.M. Stationery Office, London). 1930. Price: 9d.

Particulars are given in a report by the Director of Water Pollution, Dr. H. T. CALVERT, of the experiments on biological filtration made at Colwick beet factory. Drawings are reproduced of the plant used. Some details of this work have been given elsewhere in our columns.[1]

An Index to the Chemical Action of Micro-Organisms on the Non-Nitrogenous Organic Compounds. Ellis I. Fulmer, Ph.D., and C. H. Werkman, Ph.D., assisted by Anella Wieben and Calvin R. Breden, all of Iowa State College. (Baillière Tindall & Cox, London). 1930. Price: 20s.

This book contains three tables which should be of definite interest to those engaged in the study of micro-organisms. They present a view of the chemicals reported as produced by bacteria, yeasts or moulds on various substrates, arranged in order of organism (Table I), of substrate (Table II); and product (Table III). Such an index should be found of value generally among bacteriologists, especially zymologists.

Ratgeber des Zuckerkochers. Prof. J. A. Kucharenko. Fifth Edition. (Gustav Fock, Leipzig). 1930. Price: RM. 5.

KUCHARENKO's vade-mecum of sugar boiling previously noticed,[2] which has reached three editions in the Russian language, and one in the Ukrainian, is now published in German. It comprises a series of 18 lessons amply illustrated, each followed by a number of questions covering the points discussed. It contains nothing new to the literature of boiling in the beet factory, excepting perhaps the data on the production of Russian fine-grained white sugar. Nevertheless, the small book is interesting as probably the first attempt to describe in a simple yet scientific way the art of sugar boiling.

Dangerous Cargo. Dr. Jules Aeby, Consulting Chemist to the Red Star Line. Second Edition. (Published by the author at 43, rue de l'Empereur, Anvers, Belgium). Price: 30 belgas.

Shippers are frequently in discussion with shipping companies or their brokers on points concerning the nature of certain cargo, whether such possesses inflammable, explosive, poisonous or other undesirable qualities. Here is a work which appears generally to be accepted as an international authority regarding the suitability of cargo for shipment. It describes some 442 dangerous products in English, French and German, giving comments on their nature, and is provided with a very complete index. Those concerned with the shipping of chemical products overseas will find it, not merely a useful publication, but rather an indispensable one.

Law and Industry. G. S. W. Marlow, B.Sc., F.I.C., Barrister-at-Law. (Baillière, Tindall and Cox, London). 1930. Price: 17s. 6d.

This book is based on a series of lectures delivered a little time ago at the Sir John Cass Technical Institute, London, on "English Law as related to Industrial Chemistry," which attracted some attention among factory managers and others in responsible positions. It gives a summary of the more important aspects of the law as affecting industry, dealing particularly with torts, contracts, master and servant, the factory acts, employers' liability act and workmen's compensation, sale of goods, the companies' act, and monopolies, this latter chapter giving a survey of patent and trade mark law. An elementary knowledge of the principles of law should be a part of the equipment of everyone aspiring to responsibility in an executive capacity. A book such as this, therefore, which expresses the essentials of law as related to industry in language which can be understood by all, is certain to meet with appreciation.

1 *I.S.J.*, 1930, 585. 2 *I.S.J.*, 1928, 328.

Review of Current Technical Literature.[1]

REPORT OF THE COMMITTEE ON FABRICATION IN CUBA. **C. J. Bourbakis.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba.*

In the course of a long report, the author makes the following remarks : In spite of the high rate of grinding in Cuba, the technical results show a steady improvement, and the tendency to better prepare the cane for milling is evident. In 1929 eleven of the mills reporting to the Cuba Sugar Club showed polarization extractions between 96 and 95, and 25 between 95 and 94, following being average figures in comparison with other countries :—

	CUBA		JAVA		HAWAII		PHILIPPINES.[2]
	1928	1929	1927	1928	1927	1928	
Polarization, cane	13·46	13·80	12·90	13·50	12·32	12·55	13·11
Fibre, per cent. cane	10·63	10·56	12·70	12·70	12·49	12·50	11·55
Polarization extraction	93·69	93·84	94·40	94·50	97·23	97·26	93·74
Imbibition per cent. cane	16·55	17·55	17·52	17·90	32·53	32·16	—
Loss in bagasse per cent. cane	0·85	0·85	0·72	0·74	0·34	0·34	0·82
Moisture per cent. bagasse	—	49·33	—	45·20	41·78	41·48	—
Fibre per cent. bagasse	—	45·60	—	51·40	56·00	56·28	47·86

Returning the last juices over the preceding mills is now practised by the majority of factories ; but a systematic return backwards in steps to ensure the gradual increase in density of the diluted liquid is followed only by a few. Cleanliness of the milling equipment still receives insufficient attention, though the possibility of reducing the drop of purity between crusher and mixed juice by frequent washing with hot water or by the application of steam has been amply demonstrated. Spraying with weak hypochlorite, 2 per cent. sodium fluoride, or 1 per cent. formaldehyde have each been suggested. Continuous liming apparatus is being installed to an increasing extent in order to avoid the passage through the heaters of locally over-limed or under-limed juice zones.

Clarification control by *pH* (usually using the Hellige comparator, which dispenses with the use of buffer solutions) is being rapidly adopted in all factories ; but insufficient capacities frequently limit liming to the optimum point. Several factories practise the addition of phosphoric acid to the raw juice, especially with canes coming from lands poor in phosphates. Lime addition to the scum tanks is often carried out with insufficient control, thus undoing the beneficial effect of the preceding defecation, lowering the purity, peptizing the colloids, and increasing the soluble lime salts. Of interest in connexion with filter-press operation is the reported use of two scum pumps, one filling newly started presses at 15-20 lbs. pressure, the other finishing at 35-40 lbs., thus solving the difficulty that whenever a new press is started the flow of the other falls off. LAFEUILLE's work in obtaining great drops of purity in a single operation in his crystallizer-pan is regarded as one of the most interesting developments in massecuite treatment. In connexion with water cooling, the practice has been introduced of reheating the massecuite before spinning, thus obtaining a greater fluidity and a better product. Regarding the quality of Cuban sugars, one of the largest American refineries reported that they are easier to refine than Porto Rican and Philippine ; their grain is larger and more uniform than other raws ; but the proportion of insoluble matter is larger than formerly, due to the heavier milling practices of recent years, and there is now a tendency to furnish hazy or cloudy filtrates, especially from raws from estates, the cane of which is grown on soils deficient in phosphates. " We prefer to handle Cubans of more colour of a rather reddish tint, than, for example, Porto Ricans, having less colour, but of a greenish or greyish shade, less easily eliminated by boneblack." Following is an average analysis (for 1928 crop) of a Cuban raw sugar : Sugar, 96·05 ; water, 1·16 ; ash, 0·48 ; glucose, 0·93 ; organic non-sugar, 1·38 ; purity, 97·18 ; average dye test, 300.

2 Averages for 16 centrals of the P.I. for 1924, 1925, and 1926.

SCHEMES FOR CROP RESTRICTION (GRINDING ALL THE CANE, BUT PRODUCING HIGH PURITY MOLASSES). **J. W. B. Zaalberg.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba.*

Whether in the event of production restriction in Cuba it is more favourable to leave some of the cane in the field and proceed with manufacture as usual, or whether one should grind all the cane and produce high purity molasses, has been considered by the author. He assumes a factory grinding 10 million arrobas of cane with a normal juice extraction of 81 and showing the following results : normal juice, Brix 19·15, sucrose, 15·99, ; purity 82·0 ; press-cake, solids 45, sucrose 6·50 and sucrose per cent. cane, 0·06 per cent. ; syrup, Brix, 60 ; commercial sugar, solids 99·20, sucrose 96·50, purity 97·29 ; final molasses, Brix 88·0, sucrose 28·16, and purity 32·00. This factory obtains 205,500,000 lbs. normal juice with 39,487,500 lbs. of solids, and 32,379,750 lbs. sucrose : in the press-cake there are 1,038,465 lbs. solids, and 150,000 lbs. sucrose ; therefore in the syrup there are 38,449,035 lbs. solids and 32,229,750 lbs. sucrose, its purity being 83·82. Applying the formula :— $Wj \times \frac{B_j \times (P_j - P_m)}{B_s \times (P_s - P_m)}$, for the calculation of the commercial sugar, one obtains 30,767,417 lbs. or 94,669 bags of 325 lbs. each, the yield being 12·307 per cent. Using the formula : $\frac{W_j}{100} \times \frac{B_j\ (P_s - P_j)}{B_m\ (P_s - P_m)}$ for calculating the final molasses, the result is 9,008,815 lbs., or 735,413 gallons.

If the factory were forced to reduce its production by 20 per cent., it would make only 75,742 bags of sugar and 588,330 gallons of final molasses, leaving 2 million arrobas of cane in the fields. In order to calculate the purity to which the molasses should be exhausted in order to produce the same amount of sugar while grinding all the cane, the author uses the first formula above, taking for the weight of the juice the amount of syrup obtained by grinding 10 million arrobas of cane, and for sugar 75,742 × 325 lbs., and treating P_m, the purity of the molasses, as an unknown, this giving a final purity of 60·39. Using the second formula, it is found by exhausting the molasses to 60·39 purity, 1,301,377 gallons of it are produced. Hence under these conditions, while producing the same amount of sugar as when leaving cane in the fields, one makes 713,046 gallons more of molasses. It is now a matter of estimation depending upon the relative prices of sugar, cane, and molasses (and of the extent of the restriction), whether this scheme of grinding all the cane can be a profitable one or not. There being many factories connected with the problem, depending on local conditions, each case must be considered separately. Against the cost of cutting the additional amount of cane, which otherwise would be left in the fields, and of delivering it to the factory, one can place the economy which could be realized by boiling first strikes only, thus saving in extra fuel. But of course the deciding factor would be the price obtainable at the time for the high purity molasses which would be produced.

- - - -

EXPERIMENTS ON IMBIBITION. **N. M. Rydlewski.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba.*

In some mills in Cuba the author found the imbibition water being applied at the entrance of the bagasse to the mills, so some experiments were made with the object of showing whether this method or application as the bagasse is emerging is the more advantageous. Two mill tandems were available, each of the two having the same roll settings, the same hydraulic pressure, the same driving power, and other conditions generally as similar as possible. Hot water was used ; but the meters at hand were found unreliable for its measurement, the amount used being therefore calculated from the densities of the normal and diluted juices. Nor was the bagasse weighed, being obtained from cane, plus imbibition water, minus diluted juice. The diluted juice was weighed in RICHARDSON automatic scales, and the density of the normal juice was calculated from that of the crusher juice by means of weekly factors. In the comparison of results, the term " imbibition efficiency " as used by the Fulton Iron Works was included, which figure has been found from many milling

tests made in many factories to be a useful one. It is calculated from the formula :

$$\frac{100 - (\%\ \text{sucr.} + \%\ \text{water} + \%\ \text{fibre in the bagasse})}{\text{Brix of the last mill juice}} \times 100,$$

and a value of about 20 is taken as representing good imbibition work. Bagasse and juice samples were analysed every three hours. Below are some of the results obtained, which represent the average of figures obtained as the result of grinding some 3,500,000 arrobas or 40,000 tons of cane.

According to the author, by the increase of sucrose extracted per cent. sucrose in the cane, and by the better imbibition efficiency (with practically the same quantity of imbibition water) they are clearly in favour of the water being sprayed on the bagasse leaving the mills.

	Entering the Mills. Tandem No. 1.	Entering the Mills. Tandem No. 2.	Leaving the Mills. Tandem No. 1.	Leaving the Mills. Tandem No. 2.
Imbibition per cent. cane	13·55	19·89	13·52	15·84
Dilution per cent. cane	11·24	16·68	11·33	13·28
Normal juice extraction per cent. cane	82·93	83·87	83·86	83·83
Sucrose extracted per cent. sucrose in cane	94·40	94·66	95·22	94·91
,, ,, per cent. cane	9·60	9·76	10·18	9·89
Sucrose lost in bagasse per cent. cane	0·57	0·55	0·51	0·53
Sucrose in cane per cent.	10·17	10·31	10·69	10·42
Diluted juice, Brix	13·02	12·31	13·29	12·78
,, ,, polarization	10·20	9·71	10·69	10·18
,, ,, apparent purity	78·34	78·87	80·44	79·65
Last mill, juice Brix	5·43	5·36	4·64	4·90
,, ,, ,, polarization	4·02	3·96	3·40	3·63
,, ,, ,, apparent purity	74·03	73·92	73·42	74·10
Bagasse per cent. sucrose	2·91	2·86	2·81	2·83
,, ,, ,, moisture	49·28	29·06	49·15	48·80
,, ,, ,, fibre	46·79	47·07	47·03	47·38
Imbibition efficiency	18·70	18·80	21·70	20·20

Control of Sugar Factory Boilers. **S. Mott-Smith.** *Reports of the Association of Hawaiian Sugar Technologists*, 1930.

Taking average Hawaiian conditions, and assuming a crop of 400,000 tons of cane, the mill will yield during the grinding season 30,383 tons of bagasse over that required as fuel. This surplus may be burned under the boilers for the generation of electrical current for sale in the vicinity. Used in this way, 13,820,000 K.W.H. will be developed in a condensing turbine with a W.R. of 13·5 lbs. of steam per K.W.H., which with a valuation of \$0·009 per K.W.H. will produce a revenue of \$124,380 for the mill. But to ensure the highest efficiency possible continuously, the foreman-in-charge must have a thorough knowledge of his subject, adequate and accurate instruments must be installed, and there must be complete and reliable supervision. Instruments necessary on each boiler are : an indicating and recording steam-flow meter ; compound differential draught gauges for the furnace and boiler uptake ; a recording pyrometer for the flue gases ; and, if a superheater is installed, a recording thermometer to give the total temperature of the steam. In addition a sampling tube should be installed in the last pass, and connected to a recording and indicating CO_2 instrument joined to an Orsat gas analysis apparatus so as to check the instrument as desired. Then to the feed-water header to the boilers a recording thermometer should be inserted ; while to measure the water going to the boilers a Venturi tube or a thin-plate orifice with recording features attached will serve the purpose. Lastly, although of minor importance, a high temperature pyrometer will yield important indications.

As the possibilities of making efficiency tests on the boilers are generally not feasible, the engineer will have to resort to the heat-balance method in order to determine the operating characteristics of his plant. If operated properly, this method will yield information very valuable for an estimate of the heat losses. In order to

have a criterion by which to judge daily operation, the engineer should calculate theoretical heat balance, taking into account the inherent conditions existing. The values of this calculation should be drawn as straight lines on a graph sheet, when the result will forcibly show the conditions which must be improved in order to obtain better results. Tabulated below is a typical theoretical heat balance for average Hawaiian conditions, i.e., fibre per cent. cane, 12·5 per cent.; moisture per cent. bagasse, 42 per cent.; pol. of bagasse, 1·25; purity last expressed juice, 69; heat value of a lb. of dried bagasse 81,000 B.T.U.; CO_2 in the flue gases, 16 per cent.; and the temperature of the outgoing gases, 500°F.

Heat value per lb. of bagasse, as fired	4698·0	B.T.U.
Uncontrollable Losses per lb. of bagasse—		
Moisture in the bagasse	493·0	,,
Moisture by burning the hydrogen	460·0	,,
Moisture in the air used for combustion	16·2	,,
Controllable Losses per lb. of bagasse—	969·2	,,
Dry chimney gases	431·3	,,
Unburnt particles up the stack	nil	
Unburnt gases	nil	
Unburnt ashes	nil	
Leaks in the boiler proper	nil	
Leaky blow-down valves	nil	
Improper operation of the blow-down valves	nil	
Radiation	47·0	,,
Unaccounted for losses	23·5	,,
Total losses	1471·0	,,
Heat absorbed by boiler per lb. of bagasse fired	3227·0	,,
Efficiency of boiler and furnace	68·7	per cent.
Pounds of steam from and at 212°F. per lb. of bagasse fired	3·32	

Of the controllable gases the first one, heat in the dry chimney gases, is the largest and most diversified, being dependent on the following factors: the excess air supplied to the furnace; the condition of heating surfaces both exterior and interior; the velocity of the gases over the heating surfaces; and air leaks into the boiler setting

CLEANING EVAPORATOR TUBES. **Geo. D. Becker.**[1] *Reports of the Association of Hawaiian Sugar Technologists*, 1930.

Previous to the 1929 crop, the practice at Honomu was to boil out the evaporator on Saturday nights under the usual conditions as followed through the Islands, i.e., to each cell was added a bucket or two of cleaning material to a certain volume of water contained in the effect, boiled, washed, and brushed the following day. But during 1929 a method was devised for boiling out the evaporators that not only reduced the amount of cleaning material, but almost entirely eliminated the Sunday brushing of the tubes, which method was as follows: The cleaning solution was made up in a conveniently located tank, a solution of approximately 25 per cent. caustic soda, and in sufficient quantity to supply all cells. This alone facilitated quicker manipulation and allowed frequent succeeding boilings with the same solution, only maintaining a fairly constant concentration by the addition of more cleaning materials when needed. A phenolphthalein test was used for determining the strength of the solution. Each cell of the effect was filled to the top of the steam-chest with the prepared cleaning solution; vacuum was obtained on all cells but the pre-evaporator, steam was introduced to the first cell steam-chest; and, when sufficient temperature was reached, the boiling out of the cells was started. In the boiling out of the cells the same methods were used as in the case of juices, that is, functioning as though juices were being handled. It required from three to

1 Chemist to the Honomu Sugar Company, T.H.

four hours to boil out, depending on the amount or constitution of the scale adhering to the tubes. Water was added to each cell during the boiling-out process in order to maintain a fairly constant level of the cleaning solution. On some occasions it was very advantageous to add a small amount of screened furnace ash to the extremely dirty cells, such as the fourth body. In this method violent circulation of the cleaning solution was obtained, and, due to this circulation and to the addition of the ash, a mechanical as well as chemical cleaning of the tubes effected. Due to this method of cleaning evaporator tubes, Honomu has found it unnecessary to brush the tubes by hand except on rare occasions. For instance, during the 1929 crop, lasting 30 operating weeks, the evaporators were brushed only four times, consequently a reduction in Sunday labour was realized, amounting to \$396·72 for the crop, while the cleaning materials account showed a saving of \$744·73 ; the brushes used were greatly reduced and therefore gave a saving of \$52·00, giving a total of \$1193·45 saved by this change of method. This does not take into consideration the material saving to the apparatus by the elimination of the frequent brushing necessary in the former method. Another pleasing condition of this method was the lack of necessary mechanical changes usual to a change in any cleaning operation. This method worked extremely well at Honomu. It saved in the neighbourhood of \$170·50 per operating month. That it will prove as satisfactory in another factory cannot be said. It is certainly worth a trial.

COMMENTS ON CANE MILLING (ROLL GROOVING). **H. J. B. Scharnberg.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba.*

In order to obtain a very high sucrose extraction, it is of the utmost importance that the fibre be as finely disintegrated in the first stage of milling as is mechanically possible. The sucrose in the hard outer rind, and in the nodes of the cane, is quite high (based on total per cent. fibre in cane) ; the maceration partly saturates the marc side of the fibre, and when expressed again will leave on the same side as that on which it entered On the other hand, when the cane is well prepared, the water can penetrate from all sides, the fibre becoming thoroughly saturated, under which conditions the sucrose ultimately extracted depends on the amount of water applied, and how efficiently the return maceration is used on the mills. This, of course, is not new theory, but long established fact. Experience in Cuba shows that when grinding cane unprepared by knives the capacity of the mill is limited, especially that of the first crusher. This was overcome somewhat by changing the type and diam. of the crusher ; but much better results were obtained by the installation of cane knives, both capacity and sucrose extraction being increased considerably. If, in addition to this, the cane in Cuba were further finely prepared by a second set of knives, a shredder, or other means of disintegration, then results should be obtained similar to those found in Hawaii. However, it was found that if the cane were too well prepared the capacity dropped off at once, there being roller slippage and mill chokes. This was due to the amount of juice expressed by the crusher and first mill being so much greater with the same pressure, the grooving in the feed rolls being unable to take it.

Greater pitch grooving has, therefore, been installed, though little attention was given the traction thereby destroyed. Deep juice grooves are now also to be found in almost all cane rolls in Cuba, and are spaced according to the pitch used in the roll grooving, from 4 in. in the large grooving to 2 in. in the smaller being the spacing generally used. They have also been cut in some cases in the lower crusher rolls; and in a 3 in. pitch grooved roll with a $\frac{3}{8}$ in. × 1 in. deep juice groove in each groove the drainage area is increased a little over 8 per cent.,and would amount to 6 per cent. in 4 in. pitch roll. Claims have been made that these juice grooves give a higher sucrose extraction, but this is hardly possible. While the capacity and efficiency of the mill rolls have been increased considerably by their installation they have nevertheless been quite troublesome. Finely disintegrated cane wedged into these juice grooves is removed by special scrapers, falling into the juice pan, often to such an extent that it is necessary to wash it on the juice screens with return juice. Where deep juice

grooves are used in the cane rolls, trouble may also be experienced with the turn plates. The points of the plate entering the juice groove foul up with fibre, and retard the free movement of the crushed material passing over the plate. In order to increase the drainage capacity of the lower crusher, and cane roll grooving, and to avoid this turn-plate trouble, the grooving in these rolls is now being changed to a smaller degree angle, thus increasing the drainage area. Cross grooving cut in the top rolls has been found to improve the feeding of the cane considerably, but it must not be carried too far.

MILL SANITATION. **R. H. King,** 1930, 11, No. 11, 640-655. As the results of an investigation involving some 5000 analyses of juices, the author concludes that due to the varying quality of cane milled, the apparent purity, the *pH* and titrable acidity are no measure of deterioration. The acidity per 100 Brix is also no measure of acidity increase. Reasonable sanitation through the use of hot water at 3-hour intervals, together with a periodic removal of accumulations of bagasse and sediment, and the use of deep sloping juice pans and troughs, will reduce mill juice decomposition to a minimum. Periodic thorough cleansing of maceration lines, troughs and storage tanks is absolutely necessary in order to prevent micro-organism development. The use of lime or chemicals is not to be recommended, as they are ineffective, expensive and permit a false security. Sour odours around the milling plant should be investigated and measures taken for their prevention.—OPTICAL MEASURING INSTRUMENTS (INCLUDING HELLIGE *pH* COMPARATOR). **Anon.** *Sugar News*, 1930, 11, No. 11, 558-659. "It will be seen that the entire success of the manufacturing depends on the chemist . . . . . To cope with this situation the sugar chemist is constantly seeking for rapid and accurate methods of examination and analysis. Instrumental analysis is used wherever possible. The saccharimeter, refractometer and microscope are old friends ; but the hydrogen-ion colorimeter (Hellige Comparator) is now being used for the rapid determination of the *pH* and will no doubt become as necessary as the older instruments, since the hydrogen-ion attachment is easily removable, converting the instrument into a standard Duboscq colorimeter, making it available for the determination of phosphates, etc." Reference is made to valuable articles on the colorimetric method, viz., by SCHLEGEL and STUEBER,[1] and HOLVEN.[2]—MOLASSES IN CUBA. **C. J. Bourbakis.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba.* Molasses is now being purchased by weight in Cuba, but probably soon sales will be based on analysis. Average figures for 1929 were : total sugars, 55·21 ; polarization, 30·03 ; sucrose by Clerget, 37·08 ; difference between apparent and true purity, 11·80 ; glucose, 18·9 ; and glutose, 9·10 per cent. All these are average figures, there being a wide variation in individual cases, pointing to the desirability of purchase according to composition. In general in Cuba the control of molasses receives insufficient attention, and the amount produced should be more generally checked against the anticipated figure calculated from the juice figures. Its measurement at the factory is at present inadequate, and apparatus such as the "Pneumercator" for showing the amount by weight or by volume present in the tank should be installed.—CHEMICAL CONTROL IN CUBA. **C. J. Bourbakis.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba.* Control methods in Cuba are those of Dr. SPENCER, or of the Cuba Sugar Club, more or less closely followed, and following are average manufacturing losses, as reported to the Club in comparison with those of Java and Hawaii :—

	Cuba 1929	Java 1927	Java 1928	Hawaii 1927	Hawaii 1928
In molasses, per cent. cane	0·973	0·841	0·852	1·02	0·97
In press-cake, per cent. cane ..	0·064	0·097	0·122	0·05	0·05
Undetermined, per cent. cane..	0·063	0·208	0·214	0·06	0·06
Total, in manufacturing	1·103	1·148	1·188	1·13	1·10
Total, including bagasse	1·953	1·868	1·928	1·47	1·44

J. P. O.

1 *I.S.J.*, 1927, 427. 2 *I.S.J.*, 1930, 91.

Statistical Record of the Sugar Position in Europe.

Figures prepared by the Statistics Committee of the Brussels Conference, December, 1930, as a Basis for Negotiations.

Metric Tons	Germany	Czecho Slovakia	Poland	Hungary	Belgium	Total
Stocks—						
1st September, 1929	234,000	90,000	81,000	13,000	69,000	487,000
1st September, 1930	311,000	114,000	155,000	15,000	61,000	656,000
Normal Stocks—						
(*a*) 1½ months' Home Consumption	210,000	50,000	50,000	14,000	29,000	353,000
(*b*) 8 per cent. of net Exports	17,000	55,000	25,000	8,000	3,000	108,000
Total	227,000	105,000	75,000	22,000	32,000	461,000
Home Consumption 1929-30	1,683,000	398,000	402,000	114,000	230,000	2,827,000
Total Exports 1929-30	263,000	600,000	452,000	133,000	100,000	1,548,000
Imports 1929-30	28,000	—	—	—	75,000	103,000
Net Exports	235,000	600,000	452,000	133,000	25,000	1,445,000
Excessive Stocks, 1st September, 1930	84,000	9,000	80,000	—7,000	*29,000	195,000
Production 1930-31 (Estimated by Licht)	2,425,000	1,150,000	750,000	225,000	275,000	4,825,000
Estimated Consumption, 1930-31	1,717,000	398,000	402,000	109,000	230,000	2,856,000
Stocks available for Exports 1930-31	812,000	761,000	428,000	109,000	74,000	2,184,000

*Including Stocks that have to be re-exported.

United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

	One Month ending December 31st.		Twelve Months ending December 31st.	
	1929.	1930.	1929.	1930.
Unrefined Sugars.	Tons.	Tons.	Tons.	Tons.
Poland	295	6	57,192	46,097
Germany	...	5.343	33,261	57.828
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	....	....	20,067	607
Java	10.301	....	168,197	6
Philippine Islands	....	....	....	....
Cuba	7,168	19,196	696,149	740,772
Dutch Guiana	....	....	....	....
Hayti and San Domingo	4,688	3,675	184,454	237,439
Mexico	....	....	....	....
Peru	7.943	21.564	124,217	118,754
Brazil	....	2,570	11,527	72,642
Union of South Africa	13,605	26,532	96,755	105,713
Mauritius	58,406	22,631	275,030	136.072
Australia	31,566	36,320	211,961	185,220
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	2,313	3.754	92,414	80.498
Other Countries	21,424	21,862	75,805	71,006
Total Raw Sugars	**157,709**	**163,454**	**2,047,029**	**1,852,654**
Refined Sugars.				
Poland	....	235	....	726
Germany	108	18	1.015	805
Netherlands	525	1,000	13,849	15,113
Belgium	76	161	1.136	1.114
France	....	....	....	....
Czecho-Slovakia	4.375	4,690	29,093	31,905
Java	....	....	....	....
United States of America	663	490	10,487	9,218
Canada	....	....	10	5
Other Countries	8	7	158	135
Total Refined Sugars	**5,754**	**6,601**	**55,747**	**59,020**
Molasses { Foreign	7,763	21,952	162,026	245,183
Molasses { British	2,472	292	54,062	39,368
Total Imports	**173,698**	**192,299**	**2,318.864**	**2,196,225**

EXPORTS.

British Refined Sugars.	Tons.	Tons.	Tons.	Tons.
Denmark	46	25	1,036	1,155
Netherlands	....	..	....	....
Irish Free State	2,494	2,927	49,891	44,157
Channel Islands	139	127	1,347	1,759
British West Africa	238	92	3,094	2,054
Canada	....	....	....	....
Other Countries	12,278	6,412	111,288	229,925
	15,194	9,584	166,657	279,049
Foreign & Colonial Sugars.				
Refined and Candy	117	74	2,417	3,902
Unrefined	62	51	891	576
Various Mixed in Bond	....	....	....	....
Molasses	940	29	11,062	714
Total Exports	**16,313**	**9,738**	**181,027**	**284,241**

United States.

(Willett & Gray).

(Total of 2,240 lbs.)	1930 Tons		1929 Tons.
Total Receipts, Jan. 1st to Dec. 27th	2,582,249	..	3,376,971
Deliveries ,, ,, ...	2,841,597	..	3,032,931
Meltings by Refiners ,, ,, ...	2,916,546	..	2,946,956
Exports of Refined ,, ,, ...	77,000	..	85,000
Importers' Stocks, Dec. 27th	177,923	..	442,271
Total Stocks, ,, ...	262,568	..	592,970
	1929.		1928
Total Consumption for twelve months	5,810,980	..	5,542,636

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT NOVEMBER 30TH.

(Tons of 2,240 lbs.)	1928. Tons.		1929. Tons.		1930. Tons.
Exports	3,485,577	..	4,484,170	..	2,837,476
Stocks	287,347	..	254,694	..	764,387
	3,772,924	..	4,738,864	..	3,601,863
Local Consumption	63,004	..	96,156	..	72,277
Receipts at Ports to November 30th ..	3,835,928	..	4,835,020	..	3,674,140

Habana, November 30th, 1930. J. GUMA.—L. MEJER.

United Kingdom.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION OF FOREIGN SUGAR FOR TWELVE MONTHS ENDING DECEMBER 31ST, 1928, 1929, AND 1930.

IMPORTS.

	1928. Tons.		1929. Tons.		1930. Tons.
Refined ..	221,395	..	55,747	..	59,020
Raw	1,709,146	..	2,047,029	..	1,852,654
Molasses...	218,608	..	216,088	..	284,552
	2,149,149		2,318,864		2,196,226

EXPORTS (Foreign).

	1928. Tons.		1929. Tons.		1930. Tons.
Refined	9,806	..	2,417	..	3,902
Raw	923	..	891	..	576
Molasses	4,342	..	11,062	..	714
	15,071		14,370		5,192

HOME CONSUMPTION OF IMPORTED SUGAR.

	1928. Tons.		1929. Tons.		1930. Tons.
Refined	219,625	..	54,711	..	54,928
*Refined (in Bond) in the United Kingdom	335,011	..	3,338	..	1,182
†Raw	1,239,655	..	1,888,181	..	1,935,788
Total of Sugar	1,794,291	..	1,946,229	..	1,991,898
Molasses	8,061	..	9,171	..	7,718
Molasses, manufactured (in Bond) in the United Kingdom..	15,588	..	4	..	6
	1,817,940		1,955,404		1,999,622

STOCKS IN BOND IN THE CUSTOMS WAREHOUSES OR ENTERED TO BE WAREHOUSED AT DECEMBER 31ST.

	1928. Tons.		1929. Tons.		1930. Tons.
Manufactured from Home Grown Beet	67,600	..	101,550	..	106,500
Refined in Bond	12,350	..	3,100	..	250
Foreign Refined	12,100	..	10,000	..	7,750
,, Unrefined	182,300	..	341,900	..	247,850
	274,350		456,550		362,350

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty-paid sugar returned to refineries to be again refined. Sugar refineries ceased working in Bondas from 25th April, 1928.

† The quantities here shown include 103,377 tons entered for refining in refineries in the month ended 31st December, 1930, and 1,823,864 tons in the year ended December 31st, 1930.

United Kingdom Monthly Sugar Report.

Our last report was dated 9th December, 1930.

The markets have continued in an unsettled state during the last month, owing to the Conferences which have been taking place in Brussels between the European producers, Java and Mr. CHADBOURNE, who represents the Cuban interest. It appears that yesterday an agreement was reached in Berlin giving Germany an exportable quota over five years of 1,750,000 tons. This is slightly more than expected, but nevertheless the nervous feeling which has prevailed for some weeks past has given place to a feeling of confidence.

The London Terminal Market has had a severe drop but has recovered again. March moved from 6s. 5d., to 5s. 3d. to 6s. 3d., May moved from 6s. 7d. to 5s. 5½d. to 6s. 5d., August from 6s. 10d. to 5s. 8½d. to 6s. 8d., whilst December fell from 7s. 2d. to 6s. and advanced again to 7s.

The White Terminal Market has been stagnant except for a " squeeze " at the end of the December position, when the price rose several shillings.

The latest prices are :—

	MARCH	MAY	AUGUST	DECEMBER
Raw	6s. 2d. ..	6s. 4d. ..	6s. 7d. ..	7s. 0d.
White	7s. 6d. ..	7s. 9d. ..	— ..	—

Refined has been slow of sale. The Refiners reduced their prices by 6d. on December 30th, but advanced them by 3d. on January 7th and 3d. on January 9th. Their latest prices are No. 1 Cubes 23s. 6d., London Granulated 19s. 10½d. Home Grown factories moved their prices in sympathy with the Refiners.

Business in Raws has been confined to parcels, and at one time the price was down to 5s. 3d. c.i.f., but to-day the price is 6s. 3½d. c.i.f.

There is nothing fresh from Cuba, where the carry over at the end of the year was 1,400,000 tons.

With regard to Europe, LICHT again increased his estimate by 245,000 tons, his total for Europe, excluding Russia, now being 8,500,000 tons against 7,311,860 tons last year.

21, Mincing Lane,
London, E.C.3.
9th January, 1931.

ARTHUR B. HODGE,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 386. FEBRUARY, 1931. VOL. XXXIII.

Notes and Comments.

The Chadbourne Plan.

In spite of the numerous difficulties inherent in any world-wide trade compact, the plans for the Chadbourne scheme of sugar restriction have made steady progress, and Mr. CHADBOURNE himself has been able to return to America confident that the final arrangements will be completed. This achievement, in the face of so many obstacles and of a persistent tone of incredulity and pessimism or even defeatism— in the sugar market, can only be ascribed to the unanimous feeling amongst all sugar producers that the present market conditions— under which sugar is bought from hand to mouth and the producer is left to hold the invisible supplies as well as the visible ones - are inimical to the prosperity of the industry. Having a common cause of self-interest, these world-wide sugar producers have been the readier to sink their minor differences and to compromise in respect of their supposed incidental advantages, and though the final agreement has not yet been signed pending the ratification by a few of the countries, it seems highly unlikely that the plan will now fall through. Some rumours as to difficulties in the case of Java can very largely be discounted. A minority undoubtedly exists in that island who are opposed to any form of combination—who do not even subscribe to the V.I.S.P., and these may dislike the idea of surrendering their freedom; but we believe it is the case that none of the big Java companies—not even the Nederlandsche Indische Landbouw Mij.—have persisted in their earlier active opposition to the compact, and the Dutch East Indies Government is credited with the will to bring the few dissenters into line.

A month ago the question of Germany's quota was still in doubt, but it was finally settled on the basis of allowing her the bulk of what she had asked to be allowed to export in view of her exceptional harvest of 1930. The figures agreed to will be found set forth on another page. In order not to increase the total world quota, the other countries apart from Java agreed to a reduction in their figures by 3·5 per cent. As for Java, some earlier figures published, showing her export allowance, did not take full cognizance of the fact that she was to be allowed each year an increase in her exports by an extra 100,000 tons, if the demand in the Far-Eastern market warranted it.

Hence in the fifth year of restriction she may be able to export as much as 2,700,000 tons, if there is a market for it.

It may be added that a number of other countries who hitherto have not been participators in the negotiations are being approached with a view to joining; and the success already achieved amongst the main body of producers will probably be sufficient inducement for the rest to subscribe to the policy of restriction. Such countries include Peru, Brazil, Santo Domingo, Japan and even Russia, while British interests have been sounded as to their attitude. As to these last, it may be assumed that while the British Empire will not drop the idea of producing for itself a much larger proportion of the British sugar consumption, the last thing they will want to do will be to perpetuate the present low prices, under which some of the severest sufferers are the sugar manufacturers in British colonies.

Till the Chadbourne pact is actually in force, one must expect the sugar market to maintain its attitude of indifference if not of scepticism, but once the agreement is formally signed by the parties concerned the market will be bound to study the new factors. Under the scheme the amount of sugar being taken off the market in one way or another amounts to little short of three million tons, or roughly 10 per cent. of the world production. This is bound to have a marked effect on the relation between production and consumption, but the rapidity with which the effect will be felt would appear to depend to a considerable extent on whether the consumer and those who purchase for him are infected with a buying wave while prices are still low and start absorbing sugar for replenishing invisible stocks; or whether they persist in a hand-to-mouth buying policy in the belief that they can thereby restrict the rise in prices to a very small fraction. If the former, then the improvement in price might be very speedy once the buying wave is started; in the latter case the rise will be more gradual but should be none the less certain in the end. We see that Mr. CHADBOURNE, on his arrival in New York, is reported to have expressed the view that prices would rise eventually to 2½ cents: this figure, which incidentally is an improvement on the earlier idea that a standardized price of 2 cents was aimed at, may be over-sanguine at this stage, but it cannot be said to be beyond the range of probability; and it is the figure which Mr. CHADBOURNE lays down as fairly repaying the cost of production plus interest charges at an average factory paying living wages for its labour.

Some, at any rate, of the leading market operators are coming round to the possibilitiios of the new situation. We notice that Lamborn of New York (who quote the latest advices from Cuba as being to the effect that the crop there will be restricted to three million tons and the quota to the U.S.A. to about 2,590,000 tons), foresee in consequence that supplies for the United States for the current year will not exceed 6,124,000 long tons or practically the same as the 1930 consumption figure. This would leave little or no sugar for replacing invisible supplies or to take care of increased consumption. It will be seen, then, that (to quote Mr. GOLODETZ) the whole legend of immense over-supplies and the mistaking of under-buying for under-consumption is in some danger of bursting like a bubble. The producers must well be aware of this, and therefore have every reason for striving to carry their scheme to fruition. If the Chadbourne plan succeeds, as it now seems fully likely to, the sugar industry will be the first of the great world staple commodities to set its house in order and drop senseless competition in return for a more economic remuneration for its labours.

World Sugar Crop Estimates.

During November each year Messrs. WILLETT & GRAY are accustomed to issuing their first estimate of the current sugar crop of the world, and their tabulation is invariably looked forward to with interest. This year they have deferred issuing their forecast regarding the 1930-31 season till the middle of January. We give their figures on another page, but in studying them it has to be borne in mind that none of the restrictions agreed to under the Chadbourne scheme are even provisionally allowed for, save in the case of Cuba, where the original quota of 3,570,000 tons is given, instead of the later figure agreed to, viz., 3,305,000 tons. The figures for Europe are for the crop just completing and assume that the whole production will be available for consumption, whereas if the Chadbourne pact comes to fruition considerably less sugar will be available. Finally, Java is given the total of 2,908,000 tons in respect to the crop that was harvested from May to December last; this does not allow for the possibility that under the same pact there will be an adjustment made in the exports from Java during the year beginning next April that will considerably affect the amount of sugar available during the last half of 1931. The 1930-31 estimate is therefore merely one of actual sugar produced and ignores the question of how much of it will be available for consumption.

United Kingdom Consumption of Imported Sugar, 1930.

In our January issue we gave the Board of Trade figures of the consumption of imported sugar for the year 1929, compared with the two previous years. The amount of these Raw and Refined sugars is put at 1,991,898 tons (1,997,509 tons raw value), which compares with 1,946,232 tons (1,952,037 tons raw value) for 1929, and incidentally with 1,893,429 tons raw value in 1913. But, as is shown by C. CZARNIKOW, allowance has to be made for Exports of British Refined made from Raws returned as "consumption" and when these are deducted the net consumption raw value is 1,691,856 tons, compared with 1,775,219 tons in 1929, or about 85,000 tons less. However, these figures do not include the amount of home grown sugar also consumed. The total consumption of U.K. beet sugar for 1930 is not yet known, but is in the neighbourhood of 340,000 tons, an increase of some 80,000 tons over that of 1929. It is therefore apparent that the decline in the consumption of imported sugar has been practically offset by the increased consumption of home-grown beet, and that consequently the total consumption of the United Kingdom for 1930 approximately equals that of 1929, a point that may be considered as satisfactory in view of the course of the market and the economic conditions of 1930.

The imports of raw sugar during 1930, as shown by the Board of Trade returns, were nearly 200,000 tons less than in 1929, but then 1929 was a year of abnormal imports, registering a like increase over 1928. Of the 1,852,654 tons of raws imported during 1930, the practical disappearance of Java and Czecho-Slovakia from the lists is noticeable. Cuba increased her quota further, Brazil sent us 72,642 tons instead of 11,527, Santo Domingo sent over 50,000 tons more, while Mauritius which had shipped an abnormal amount of sugar towards the end of 1929 only shows 136,072 tons or just half her 1929 quota. The imports of refined, both as to quantity and origin, differ very little from the data of 1929.

United States Consumption in 1930.

According to Willett & Gray, the consumption of sugar in the Continental United States for the calendar year 1930 was 5,599,377 long tons expressed in terms of refined sugar, as compared with 5,810,980 tons in 1929, or a decrease of 211,603 tons, say 3·64 per cent. This brings down the *per capita* consumption figure below 100 lbs. for the first time since 1924, the 1930 figure being 99·37 lbs., as compared with 108·13 in 1929. The meltings of the U.S. Atlantic ports were about the same as in 1929, but the output of the Gulf and other southern refiners was less by some 250,000 tons, while the Pacific ports also showed a slight reduction. The import of foreign direct consumption sugar was about 87,000 tons less at 330,011 tons. The Louisiana cane crop just exceeded that of 1929, while the U.S. beet crop was some 95,000 tons greater. Hawaii contributed 102,000 tons less, Porto Rico 267,000 tons more, the Philippines 67,000 tons more, and Cuba some 558,000 tons less. Of the refined sugar consumed, 20·76 per cent. was manufactured by the American Sugar Refining Co., 54·24 per cent. by the other U.S. refiners, 17 per cent. by the beet factories, while 8 per cent. was direct consumption sugar.

The course of prices of 96° centrifugal sugar, Cuban basis, c. & f. New York, for the year 1930 was steadily downward from the opening quotation of 2·06 cents per lb. With some fluctuations the descent, which was most precipitate during April, May and June, reached its record low figure of 1·04 cents at the end of September. During October there was a rapid rise to 1·50 cents, between which figure and 1·34 cents there were fluctuations till December. Then there was another descent to 1·15 cents at the end of that month, but the price recovered on December 31st to 1·25 cents. The first nine months of the year reflected the prevailing gloom due to the excessive stocks in hand, while the improvement in October and the subsequent fluctuations were almost entirely due to the development of the Chadbourne plan with its vicissitudes of hope and scepticism.

The Position of the Sugar Industry in England.

Last year the beet sugar industry in England had its record year of production, and some 350,000 acres were devoted to sugar beet cultivation. Amidst a miscellany of unprofitable cultivation that added to the general agricultural depression in this country, the beet industry alone proved profitable to the farmer and saved many agriculturists from financial disaster, while providing thousands of field and factory workers with a living. But 1930 was the last year in which the middle stage of the subsidy—13s. per cwt. operated, and for the next three and final years of its operation the amount of the assistance will be no more than 6s. 6d. per cwt. Accordingly, the factories have advised the farmers that they will no longer be able to pay for roots on the old scale, and as they have so far—hard on the start of the 1931 sowing season—failed to come to an agreement as to a fair rate of payment, what is virtually a crisis has arisen, and the industry is threatened with a serious setback unless the Government can be induced to maintain the subsidy at its 1930 figure or, as some suggest, suspend an equivalent amount of the excise duty.

It would appear that the factories have not all spoken with one voice. The Anglo-Dutch group of five factories has made a separate and distinct offer to which we refer below. Twelve of the remaining factories, including the Anglo-Scottish group, have come forward with an offer of 37s. 6d. per ton for

17½ per cent. sugar, with 2s. 6d. for each point of variation, which makes the price for 15½ per cent. only 32s. 6d. The growers' committee ask for a minimum of 40s. for 15½ sugar, a price which is not considered excessive in view of the conclusions of the Cambridge economists who went into the matter of costs of production: 43s. for 16½ sugar; and 46s. for 17½ per cent. There is thus over 10s. at dispute for the minimum and about 8s. 6d. as regards the bulk of the production. The factories admit that their offer is hardly enough to justify the farmer in producing the roots, but they aver that it is the best they can offer, in fact rather more, they say, than the circumstances warrant. The farmers stick to the view that anything below their minimum would not secure the necessary acreage. So there ensues an impasse, and it is suggested that the next step must lie with the Government who cannot lightly allow the farming industry to lose its only profitable crop these days.

The Anglo-Dutch group was, as we said above, not a party to those price offers (it is reported to have considered them too high), and after they were made, it came forward with the unusual offer to treat this year's crop of beets at the bare costs of operation, plus an allowance for depreciation which presumably will be reckoned on the heavily written down valuation of the assets, and to utilize the whole net proceeds of such manufacture in payment to farmers for beets delivered. The farmers' sugar beet committee has considered this offer "carefully and sympathetically," but has decided to refuse it, holding that no contract for the growing of sugar beets which does not provide for a minimum price will secure sufficient acreage to enable factories to work at anything like their full capacity. In other words, the farmers would appear to feel that while the costs of production on the agricultural side are well known, and substantiated by expert investigation, far too little is known about the actual cost of manufacture at the factories to warrant their judging whether this proposed method of payment will be better or worse than the offer of a minimum price such as the other factory groups make them. So they elect to decline any participation in what would be a shot in the dark.

As a corollary to the above summary of the situation it may be added that the Executive Committee of the British Sugar Beet Society have had the matter before them the last few days and have seen fit to pass a resolution to the effect that they "view with the greatest concern the crisis which has arisen and urgently call upon the Government to remit the Excise Duty as being the only effective means of avoiding a collapse of the industry and a great increase in agricultural unemployment." The question has also been raised in Parliament, and it is stated that the Prime Minister has received a deputation urging the claims of the industry. In any case, he will need to come to an early decision as to the fiscal aspects of the matter, since preparations for the spring sowings cannot be deferred much longer.

Readjusting Cuba's Economic Forces.

The radical changes that are taking place in Cuba's economic structure as a result of the collapse in price of sugar are strikingly shown in a study recently issued by the U.S. Department of Commerce, entitled "Cuban Re-adjustment to Current Economic Forces."

"For many years practically every commercial and industrial activity of Cuba has been more or less dependent on the status of sugar. When it is considered that ten years ago this commodity was bringing in the neighbourhood of 23 cents a pound, while at the present time the price is close to 1 cent,

it is easy to realize that drastic economic adjustments have been necessary." True, that figure of 23 cents was an abnormal one, but taking the average price of 1924 (4·28 cents.) as a more normal instance of a good price, the prices of the subsequent years have been in terms of 1924 : 1925, 60 per cent. ; 1926, 54 per cent. ; 1927, 66 per cent. ; 1928, 56 per cent. ; 1929, 43 per cent. ; and 1930 about 25 per cent. As a consequence, the drop in the Cuban national income from sugar since 1924 is one that runs into hundreds of millions of dollars, and this loss is reflected in the changed mode of life both in town and country. In the country canefield labour is being paid as little as 40 cents a day, and the labourer, who in better times insists on consuming sundry imported manufactured foods, nowadays manages to nourish himself and his family on locally grown food, such as plantations, yucca, mangoes, and cakes made chiefly of brown sugar. He is, however, learning to cultivate more of his food requirements, especially corn and rice, and the surplus is finding its way into the towns. The town dwellers, who in better times drew their income from the profits on sugar, have been latterly forced by circumstances either to go back to their country estates to work, or else have turned to other occupations. The result of this is that the country as a whole is developing a well-conceived plan of diversification of agriculture and the development of manufacturing industries to produce locally articles hitherto imported. The movement is only in its initial stages, but it opens out strong prospects of a new economic era for Cubans in which, instead of being virtually dependent on sugar and tobacco for their income, they will progressively develop production of nearly everything they need for ordinary living, steadily enlarging the volume of self-contained economic activity, and reducing their dependence on foreign countries for their needs, especially in food. Thereby they hope to restore their national prosperity on more enduring lines.

Realization of the need for more diversified industry and its successful development will go much further towards restoring Cuba's economic stability than any persistence in an attempt to maintain the island as the world's biggest sugar producer. The need of the sugar industry in Cuba is a reduced cost of production, and this will probably be more easily secured by confining production to those areas and factories where economies are most naturally forthcoming. As the above Study remarks, the industry is in the beginning of a great re-organization, initiated on the part of large combinations which realize the necessity of improving and intensifying the industry, if it is to continue to exist on a large scale. Plans have been projected to concentrate the activity of sugar cane agriculture, to intensify cultivation by artificial irrigation, and to introduce many new forms of mechanical aid. Greater output in the areas near the factories should, it is asserted, enable the millers to dispense with cane from more distant areas, thereby saving costs of haulage. This will necessarily displace a number of cane farmers and the labour dependent on them, but it will be a factor in inducing these last to turn their attention to other forms of culture, and the readjustment should help to evolve an economic system founded on a broader, steadier, and more flexible foundation.

The Colonial Sugar Refining Company, Ltd.

The Colonial Sugar Refining Company Ltd., which has a paid up capital of £5,850,000 and owns all the refineries in Australia and New Zealand, as well as a number of sugar mills in Queensland and Fiji, made a profit for the half year ending September 30th last of £350,726 (after providing for depreciation

and other charges) and, adding the balance of profit and loss at 31st March, 1930, of £390,488, there was a total balance available of £741,214. A dividend of 20s. (5 per cent.) and a bonus of 5s. were declared by the directors, and £375,589 was carried forward. At the shareholders' meeting, the chairman (Mr. E. W. Knox) said that at all the mills in 1930 the cane crop suffered from deficient rainfall, that in Fiji being the lowest in their records. In consequence, the cane though having a high sugar content gave difficulties at the mills. Since then ample spring rains have brought good growth for the 1931 crop. In Australia the low value of that proportion of the sugar which had to be exported reduced considerably the millowners' profit, as it did not net more than half the cost of its production. In Fiji the crop yielded no profit, despite the preferential duty in Canada and Great Britain.

As to the future in Australia, the agreement between the Commonwealth and the State of Queensland comes to an end next August and terms for the renewal of the contract are now being discussed. Mr. Knox said that his Company were asked to take part in the conversations, but replied that they had not been consulted in any way about the prices prescribed in preceding agreements, so did not wish to be brought into the discussion now. But they were pressing the point that the margin of profit now received for handling, financing and refining the sugar will not bear reducing. To give some idea of the sum the Company have to find to finance the crop, Mr. Knox mentioned that the fire insurance policy they took out to cover the raw sugar in their stores was for the sum of 6¼ millions, the risk being divided amongst 72 companies.

British Colonial Sugar Crop Reports.

From Barclay's Bank (D.C. & O.) Monthly Review we compile the following information on current conditions in the British sugar colonies: *Mauritius.*—Last season's sugar crop has now been completed and cannot be regarded as satisfactory, either as to tonnage or price. It came to about 215,000 tons, and the whole has been sold at a price which returns to the planters about £8. 15s. 0d. per ton of sugar; this figure, however, includes £1 per ton on account of Government assistance. For the new crop all districts report good rainfall which is benefitting the standing cane. *Barbados.*—Hot dry weather has prevailed during the last three months, especially during November, and the growing sugar crop has suffered in consequence. During December a few showers fell, but left the crops in need of heavy rains. The yield of the coming crop will as a result hardly come up to the earlier estimates of approximately 65,000 tons of sugar. Nothing has yet definitely materialized in regard to the schemes designed to give relief to the sugar industry of the island, which have recently been the subject of debate in the local legislature. *Trinidad*—The weather in November was beneficial to the crops, but in December the rainfall proved inadequate and resulted in the sugar canes making little growth; fortunately there was practically no damage by insect pests to report. By January excellent rains had been experienced which improved matters. *Jamaica.*—Weather conditions have been favourable during the last quarter, except in Westmoreland. The reaping of the 1930-31 sugar crop is now in full swing; the output is expected to be quite good, although not so large as that of 1929-30 when 64,697 tons were produced. The new sugar refinery erected by the United Fruit Company in Vere is in operation; the sugar is reported to be excellent in quality and should find a ready local market. According to latest advices the subsidy of £2 per ton on

locally-produced sugar, which was granted by the Jamaica Government for the 1929-30 crop, will not be continued to planters in respect of the 1930-31 season. *Leeward Islands.*—The weather during the last quarter has on the whole been favourable to the growing cane, but further rain is desired. *British Guiana.*—The weather latterly has been seasonable with good rains. The 1930 sugar crop has been completed and estimates have been exceeded on several of the larger estates. For the 11 months ended November 30th last, 103,487 tons of sugar was exported, as compared with 82,634 tons in the corresponding period of 1929. Meantime, conditions in the sugar industry remain acute, and all estates are being conducted on the absolute minimum of expenditure.

Clyde Sugar Refining in 1930.

According to Mr. J. S. WINGATE, of the Greenock Sugar Refiners' Association who contributes a short account to the *Glasgow Herald* annual commercial supplement, the output of sugar from Clyde refineries continued to expand during 1930, the quantity of raw sugar melted—approximately 194,325 tons—showing the substantial increase of 28,545 tons over the year 1929. A moderate portion of this increase is accounted for by the execution during the summer of an order from Russia, but, apart from that, the advance was still satisfactory. The augmented melt has been sufficient to keep the three active refineries employed more or less continuously throughout the year, and, along with the additional work created for auxiliary industries, has provided employment which is specially welcome in the West of Scotland at the present time. The conditions under which the raw sugar was purchased were not favourable for the refiners, as the price of raws, c.i.f. U.K., fell steadily through the year, from about 8s. 3d. in January to about 4s. 9d. at the beginning of October. For the greater part of the year the refiners were thus working in a continuously falling market. There was a considerable dislocation of business near Budget Day owing to the uncertainty as to the continuation of the sugar duties. No change, however, took place; and since then the Government has undertaken, subject to Parliamentary control, not to interfere with the existing preferences for a period of three years, so the year closed with a feeling of much greater tranquillity regarding the position of the sugar duties. Their abolition would undoubtedly bring about a great increase in the import of State-assisted Continental beet refined sugar into the United Kingdom. Scotland in former years received a large proportion of this sugar, and any consequent diminution in demand of the home refined article would create an unwelcome addition to the existing volume of unemployment.

CONDITIONS IN ARGENTINA.—World over-production of sugar has militated against the development of the sugar industry in Argentina, says a D.O.T. Consular Report, and present market conditions have brought along a serious condition in the sugar districts of that country. It was hoped partially to remedy this state of things by a law passed in 1928 by the Province of Tucuman, compelling the export of at least 20 per cent. of the crop. This has done little to ease conditions, and stocks estimated at 195,000 tons were at hand at the commencement of the milling season in June. The prospects for the current crop are not very good, growth being a month backward at the end of October, but if production shows a decrease on last year's figures, it may help to clarify the situation and assist future operations. Various schemes of financial assistance to sugar mills have been proposed, but so far have not been put into effect.

ESTD. SMITH 1837.

DESIGNERS AND MANUFACTURERS
OF
CANE SUGAR MACHINERY
OF EVERY DESCRIPTION

THREE 11'-0' DIAM. "COIL TYPE" VACUUM PANS
EACH
1,000 SQUARE FEET HEATING SURFACE.

A. & W. SMITH & Co. LTD.
Eglinton Engine Works, GLASGOW

TELEGRAPHIC ADDRESS · "ENGINE," GLASGOW.
LONDON OFFICE — 8, GROSVENOR GARDENS, S.W.1.

The 1930 Brussels Sugar Convention.

The Provisional Terms of Agreement.

According to various official communications issued since the Brussels Conference met in December, the following are the main particulars of the agreement provisionally arrived at by the participating countries.

It was agreed to that the quantities of sugar which constituted the stock in hand on September 1st, 1930, should be segregated and should be released by equal annual amounts over the next five years. These stocks were :—

		Annual Release
Cuba	1,500,000 ..	300,000
Java	500,000 ..	100,000
Europe	636,000 ..	127,000

It was also agreed that those countries which during the first year of restriction produced more than the allotted amount of sugar should take steps during the subsequent four years to reduce their output each year by one quarter of that excess.

Cuba agreed to limit her annual exportation of sugar to the U.S.A. during the next five years to 2,800,000 tons; and reduce her production in 1930-31, and the subsequent four years to 3,570,000 tons per annum. She engaged not to export to destinations outside the U.S.A. more than 620,000 tons in addition to the annually released 300,000 tons, either directly or through the agency of American refineries or exchanges. On the other hand, her limit of production may be extended during the first two years by the amount that the consumption of the United States exceeds its figure of the previous year and during the three subsequent years by half that amount.

It was stated that the producers of beet sugar in the U.S.A., and the cane sugar producers of Louisiana, the Philippines, Porto Rico, and Hawaii had undertaken a "gentleman's agreement" not to exceed their production figures of 1930, except that during the last three years of restriction they can share with Cuba the increase if any in the U.S. consumption. This form of agreement is designed to obviate the difficulties arising from the provisions of the American Anti-Trust laws.

Java undertook to limit her annual production so as not to export more than 2,200,000 tons of her crop, thereby to absorb the excess of 400,000 tons already planted for the first year of restriction. In addition, she draws from the quantity segregated an annual amount of 100,000 tons and is authorized to increase her production annually by any amount not exceeding 100,000 tons as shall be warranted by any increased demand for sugar.

Her exports, including the quota released from segregation, must therefore not exceed :—

	Tons		Tons
1931	2,300,000	1934	2,600,000
1932	2,400,000	1935	2,700,000
1933	2,500,000		

On the other hand, if, contrary to expectation, the increase in sugar consumption should not prove so great as Java at present anticipates, so that there is a fear of new stocks increasing in the country of production, Java undertakes to adopt the necessary measures to restrict production, so that an increase in such stocks may be prevented.

Exportation allowed under the Chadbourne Scheme.

(In Metric Tons, except Cuba which is Long Tons.)

	1st Year	2nd Year	3rd Year	4th Year	5th Year
Cuba*—					
Production	3,305,000	3,455,000	3,505,000	3,505,000	3,505,000
Drawn from Quantity segregated	300,000	300,000	300,000	300,000	300,000
	3,605,000	3,755,000	3,805,000	3,805,000	3,805,000
Of which exported to U.S.	2,800,000†	2,800,000	2,800,000	2,800,000	2,800,000
Exported to Countries outside U.S.	655,000	805,000	855,000	855,000	855,000
Cuban Consumption	150,000	150,000	150,000	150, 000	150,000
Java*—					
Exports	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000
Drawn from Segregation	100,000	100,000	100,000	100,000	100,000
Allowance for Expanding Far Eastern Market	—	100,000	200,000	300,000	400,000
	2,300,000	2,400,000	2,500,000	2,600,000	2,700,000
Czecho-Slovakia Exports‡	571,000	571,000	571,000	571,000	571,000
Germany „	500,000	350,000	300,000	300,000	300,000
Poland „	309,000	309,000	309,000	309,000	309,000
Hungary „	84,000	84,000	84,000	84,000	84,000
Belgium „	30,000	30,000	30,000	30,000	30,000
	7,399,000	7,499,000	7,599,000	7,699,000	7,799,000

It should be noted that the first year begins: For Cuba on January 1st, 1931; for Java on April 1st, 1931; and for Europe on September 1st, 1930 (i.e., it has therefore already commenced).

* Sugar *telquel*.
† In the first year the contingent for the U.S.A. has been reduced to 2,577,000 tons, as a consequence of the deficient consumption in 1930 in that country.
‡ Calculated on the Raw Sugar basis.

The 1930 Brussels Sugar Convention.

The sugar-exporting countries in Europe, viz. Germany, Czecho-slovakia, Poland, Hungary and Belgium offered not to export more sugar during the next five years than 85 per cent. of the aggregate export in 1929-30.

This was as follows :—

	1929-30 Tons		85 per cent. Tons
Germany	235,000	..	200,000
Czecho-slovakia ..	600,000	..	510,000
Poland	452,000	..	385,000
Hungary	133,000		113,000
Belgium	25,000	..	21,000
Total	1,445,000	..	1,229,000

The following quotas were however proposed at the Conference :—

	Tons
Germany	200,000
Czecho-slovakia[1]	590,000
Poland	320,000
Hungary	87,500
Belgium	31,500
	1,229,000

If, in consequence of circumstances as yet unforeseen, a scarcity of sugar should occur, this quota may be increased according to a plan further to be determined for the purpose of preventing the occurrence of a shortage and excessive prices.

All the countries acquiesced in this quota arrangement with the exception of Germany who asked for an export of 600,000 tons in the first year and 375,000 tons in each of the following years, or 420,000 tons per annum, thus making the total 2,100,000 tons instead of 1,000,000.

Later Germany reduced her offer to 450,000 tons in the first year, and 350,000 tons in each of the following years, viz. a total of 1,850,000 tons. This increase of 850,000 tons in five years, or an average of 170,000 tons per annum, would then have had to be deducted from the export quotas of Cuba and Java, and this point of difference still remained when the delegates left Brussels. On December 20th, a meeting of the German sugar manufacturers was held, when the above-mentioned amounts of 450,000 and 350,000 tons were insisted upon as the extreme limit, but the expectation was expressed that a middle course between this offer and that of CHADBOURNE might yet be found. Finally, on January 8th a meeting took place in Berlin between Mr CHADBOURNE and delegates from the German, Czecho-slovakian, Polish, Hungarian and Belgian sugar industries, at which the above-mentioned difference was distributed.

In the first year Germany shall be entitled to export 500,000 tons, in the second year 350,000 and in each of the following years 300,000 tons, making in all 1,750,000 tons, in place of the 1,000,000 originally proposed and the 1,850,000 last offered. The 750,000 tons additional allowed to Germany are taken from Cuba's contingent to the extent of 575,000 and from that of the other four countries to the extent of 175,000 tons, in each case spread over five years. This distribution was effected by each country surrendering about 3½ per cent.

The maximum exports are therefore limited to the figures shown in the adjoining Table.

[1]Czecho-slovakia had already restricted its export in 1929-30 and was thus entitled to more favourable treatment.

The Italian Sugar Campaign of 1930.

Only a few years ago the regular delivery of beets to the Italian sugar factories started no earlier than the first half of August and the campaign normally lasted beyond the first half of October. But this year regular cropping started before the end of July in the case of most of the factories ; and many usines having increased their producing capacity considerably during the last few years, it was possible in 1930 despite the abundance of the harvest to bring the campaign rapidly to an end. For this reason 23 out of the 51 factories at work had finished by the end of September, the remainder continuing in operation for another fortnight. The first half of September experienced favourable weather for the deliveries, but the second half was wet and hampered operations. The bad weather however affected the mean sugar content much less than was feared, thanks to the expedition with which the bulk of the crop had been handled.

The total production of beets is calculated at 3,289,000 tons, being an average of 29·3 tons per hectare (11·95 tons per acre) on a cultivated area of 112,125 hectares (about 277,000 acres). In 1929 the cultivated area was 116,111 hectares (about 287,000 acres), and the total production of roots reached 3,096,884 tons, equal to an average of 26·6 tons per hectare (10·8 tons per acre).

The production of sugar in the 1930-31 campaign, expressed as refined, amounts to about 365,000 tons, as against 388,000 tons in 1929-30. The mean production of white sugar per hectare has fallen from 3·34 tons in the 1929-30 campaign to 3·25 tons in the present one (1·35 tons and 1·31 tons respectively per acre), despite the fact that the crop has been this year quantitatively more abundant. The reduction is due to lower sugar content, that reached in the campaign of 1929-30 being the exceptionally high one of 16·58 per cent., while this year it has fallen to less than 15 per cent.

Even in the crop of 1930-31 the Italian production of sugar slightly exceeds the national consumption, which is calculated at 350,000 tons ; and the stocks of unsold sugar will certainly increase by August, 1931. This is all the more evident from the fact that imports of sugar tend to expand owing to the very favourable c.i.f. offers continually received from every other producing country.

In the first five months of this year the sugar importations reached 5499 tons and 5,985,492 lire, against 11,128 tons in the same months of 1929. In June, 1930, the permanent and temporary imports of sugar amounted to 2690 tons and in July to 2388 tons. The exportations of sugar from Italy reached 3154 tons in the first five months of this year for 7,952,226 lire, against 2801 tons in January-May, 1929. In June, Italy exported 818 tons of sugar, in July 740 tons, in August 840 tons and in September 878 tons.

For the growers, whose chief interest is in the sugar content (since they are paid on that basis) the results of the 1930-31 campaign have certainly not been favourable. But prices having fallen to quite a low level on the international market, most offers on the Italian market were influenced ununfavourably, being lowered to quite unexpected limits. Sugar that was worth from £12 to £13 sterling before the War, was quoted in October last between £6 and £6s. 10s., c.i.f. Italian ports, and sales carried out by the different factories had to be adjusted accordingly.

Stainless Steel Gauze.—An American wire cloth manufacturing company announces that wire cloth of stainless steel has been commenced by them ; all sizes, can be supplied even as fine as 200 × 200 (40,000 openings per sq. in.), if quantity orders warrant.

The Sugar Industry in China.

(I).—The Import Trade during 1929.

(Communicated by Walter Buchler.)

The following is an extract from the Report on Trade in China by the Chinese Maritime Customs, for the year 1929 :—

" Although Customs statistics show heavy importations—three-quarters of a million piculs more being imported during 1929 than in the previous year —the sugar trade, especially during the latter half of the year, experienced a period of unusual depression. This position has developed primarily as a result of the deplorable decline in exchange, together with the generally unsettled state of the country and a clouded political horizon aggravated by large speculative purchases made early in the year at comparatively high prices. The revised import duties did not lay any special burden directly on the trade, but the classification of some grades of sugar did indirectly affect certain Java products. With the withdrawal of the boycott against Japanese goods, Japanese refined sugars again entered into competition with the Java product, causing prices to sag, while in South China the trade was further handicapped by the abundance of the sugar cane crop harvested in the East-River districts. In Shanghai stocks throughout the year were consistently heavy, the failure of the crops in the more important areas having greatly reduced the purchasing power of the inhabitants, and the off-take of sugars was very poor, especially during the last four months of the year. Owing to the heavy losses suffered by dealers as well as by many of the native banks, business both locally and with the interior virtually came to a standstill, dealers lacking the facilities to enable them to take delivery of their purchases and credit terms to up-river buyers being greatly restricted. The decline in sugar prices in the controlling markets of the world has naturally been an important contributory factor, but the predominating influences which have crushed the sugar trade in China are those mentioned above."

Net Imports of Sugar into China.

	1928		1929	
	Piculs.	H. Taels.	Piculs.	H. Taels.
Sugar, Brown, under No. 11 Dutch Standard, and "Green Sugar"	3,032,614	17,597,611	3,146,470	17,987,190
Sugar, White, over No. 10 Dutch Standard	6,169,406	44,896,325	7,790,573	54,361,523
Sugar, Refined	4,110,793	31,279,707	3,008,830	21,355,663
,, White, Cube and Loaf	21,016	234,472	35,527	329,115
,, Candy	405,652	4,105,371	409,976	4,109,608
,, not otherwise recorded	2,506	69,214	40	504
Molasses	340,047	515,223	433,589	616,942
Total Sugar		98,992,553		98,760,545

1 picul = 133⅓ lbs. 1 Haikwan Tael = { 1928 = 2/11[illegible]d. 1929 = 2/7[illegible]d. }

(II).—China as a Potential Market.

(Abridged from " Commerce Reports.")

China has long been regarded as a potential sugar consumer, but the purchasing power of the Chinaman is small and if the consumption of sugar is to increase the price must be kept low. In 1924 the *per capita* consumption of sugar was put at only 4 lbs., but at present is believed to range between 4½ and 5 lbs. This low figure is due to the poor standard of living of the masses. The poorer classes enjoy sweets, but consume sugar and candy

sparingly. Agricultural products having a high sugar content, such as raw sugar cane and baked sweet potatoes, are sold on the street by the hawkers, as is hard candy of a decidedly poor quality. The Chinese use little coffee and still drink their tea unsweetened. Sugar candy or rock sugar is regarded as a luxury, selling as a sweetmeat in the interior. Soft white sugar is the most popular, being eaten with chopsticks.

Both cane and beet sugar are produced in China, the former having been cultivated for centuries, and records show that fair amounts of Chinese sugar were imported into New York during the 18th century. It has always been regarded as a luxury and has often constituted the tribute to the ruler from those provinces that cultivated it. Cane sugar is now produced principally in the provinces of Szechwan, Kwantung, and Fukien. The estimated production in these provinces during 1927 was between 210.000 and 235,000 long tons. Beet sugar is produced principally in Manchuria and the provinces of Shansi and Hopei.

According to latest reports, there are ten refineries and six sugar factories in China, Hong Kong and Manchuria. The great bulk of the sugar made is produced in small mills employing crude processes. Three kinds of sugar are made, green (dark brown), brown (light brown) and white. The imported sugar is divided into five varieties—brown, white, refined, cube or loaf, and sugar or rock candy, Java, Hong Kong, Japan and Formosa being the principal suppliers. Brown sugar is used largely by the refineries for mixing with native sugar, but is also extensively employed by confectioners and bakers, and by native doctors. White sugar is classified according to colour, the best grades being used by households of the better classes. Refined includes all sugar treated with bonechar, or of a colour equalling or superior to No. 26 D.S. Sugar candy shows a wide latitude, including all kinds of sugar in large crystals, rock candy being the most popular.

Shanghai and Hankow are the most important sugar markets. Dealers from several Provinces have buying offices established there, as well as in Hong Kong, Tientsin, and Swatow. The trade is believed to be shifting from British to Dutch control, as sugar from Java and Sumatra is selling in the local markets at prices less than the British product.

Only a few of the largest firms have an established marketing system. They have Chinese dealers throughout the interior who are bonded to the importing firm through the deposit of title deeds, bank guaranties, or other collateral. Sugar is shipped to the dealers on open account, and at the end of each month or other stated period the dealers remit to the firm the receipts, less selling commission from the sales. The ordinary importing firms do not have agents. They obtain orders for future delivery from the local sugar merchants and in turn place these orders abroad. Upon arrival of the sugar in the port, the firm notifies the local merchants, who, according to the terms stipulated in the buying contract, take delivery in 10 days, 1 or 2 months. The practice of taking delivery in 10 days is becoming quite general. The volume of "spot" business is insignificant. After taking delivery of shipment from the importing firm, the local merchant effects shipment to his customers throughout the region.

Brown sugar manufactured in China and Japan is packed in mat bags, re-inforced with rattan or split bamboo strips of 133 lbs. (1 picul) to 200 lbs. (1½ piculs) net weight. Brown sugar from Java and the Philippine Islands is packed in jute bags of 220 lbs. net weight. White and refined sugar manufactured in China and Japan and white sugar from Java is packed the same as

brown sugar. Refined sugar from Java and white sugar from Cuba is packed in double jute bags of 220 lbs. (100 kilos) net weight. Refined sugar from Hong Kong is packed in single jute bags of 133 lbs. or in cotton bags of 100 lbs. Cube and loaf sugar is packed in cartons of 1 lb. and 5 lbs., and shipped in cases of 50 lbs. net. Sugar candy from Java is packed in jute bags of 333 to 360 lbs. net weight, while that from the United States and Europe is in jute bags of 100 lbs. net, and that from Japan in wooden cases of 6·7 lbs. Upon arrival in China, the sugar candy is repacked in cartons and tins, ranging in size from an ounce or so to 5 or 10 lbs. net. This article is in high favour as a gift, and for this reason the cartons and tins are usually very attractive.

Imports of sugar into China during the last five years, for which statistics are available, according to statistics taken from "Foreign Trade of China," issued by the Inspector-general of Customs at Shanghai, were as follows:—

Year.	Long Tons.
1928	818,091
1927	599,715
1926	696,600
1925	687,275
1924	530,360

Competition in the Chinese sugar market is very keen. If one is to compete successfully, it will have to be on a price basis, meeting quality requirements on a parity with competing sugars now established in the local trade. To be introduced successfully, it may even be necessary to sell slightly below current prices, until a foothold is obtained.

MODERN FERTILIZERS.—The composition of some of the new I.G. fertilizers is as follows: Leunasalpeter, nitrogen 26 per cent. (minimum, with 16 per cent. ammonia nitrogen and 10 per cent. of nitrate nitrogen); urea, nitrogen 46 per cent.; Leunaphos IG, nitrogen 20 per cent. and phosphoric acid, 20 per cent.; Nitrophoska IG No. 2, nitrogen, 15, phosphoric acid, 11, and potash, 26½ per cent. Nitrophoska IG No. 3, nitrogen 16½, phosphoric acid, 16½ and potash, 21½ per cent., AmmoPhos contains 16·45 per cent. of nitrogen as ammonia and 20 per cent. of available nitrogen.

STANDARD SOLUTIONS.—Definite qualities of reagents are now being supplied in glass tubes or small bottles for preparing standard solutions for volumetric analysis, each tube containing the exact quantity necessary for making 1 litre of the desired titre. Besides N/1 and N/10 solutions of acids and alkalis, iodine, thio, arsenite, silver nitrate, etc., the necessary amount of copper sulphate for the blue constituent of Fehling's solution is put up. These standardized reagents should be of distinct interest to the sugar factory chemist, who as a rule has little time to spend on the preparation of volumetric solutions. Standard solutions prepared in this way are claimed actually to cost less than ready-made solution, besides which there are the advantages of convenience and accuracy. Accuracy is guaranteed within 2 parts per 1000.

SCALE PREVENTION.[1]—Proposals to prevent scale deposition in boilers by passing a small direct current through the boiler-shell may appear fanciful; but there now appears to be sufficient evidence from factories in Europe in which the process has been tried out since 1924 to pronounce the idea practicable. Water holds in solution salts, the particles of which may be electro-positive or electro-negative, according to the composition of these salts; and if water and shell be held at the same electrochemical potential active corrosion must cease. Whether or not a correct explanation is to be given on these lines, it has been found in boilers, heat-exchangers and like plant that whereas the scale had always deposited in very hard layers, now it is present when such a device is employed in the form of flakes, or as a suspension. Shortly trials will be made with sugar factory evaporators. Operating cost is a minimum, being the equivalent for each boiler only of the cost of running a 100-Watt lamp continuously.

[1] *Ind. Chem.*, 1930, 494.

Fighting the Moth Borer in British Guiana.

The following Note,[1] prepared by Dr. J. G. MYERS of the Imperial Bureau of Entomology, after a three months' study of the sugar cane fields of British Guiana, is considered of sufficient importance to be reprinted in full.

Under present conditions in British Guiana there is only one really serious insect pest of sugar cane and that is Diatraea. But infestation by this borer is higher in British Guiana than in any other country we know of.

Enough is now known about this insect to show conclusively that if this is to be regarded as a problem to be solved once and for all, rather than as a permanent nuisance to be mitigated by mere *ad hoc* and partial methods, fundamental research is necessary into every phase of Diatraea ecology. I feel confident that even three years of such investigation as that outlined below would bring us measurably nearer to a final solution ; provided that a first-class entomologist with the necessary ecological outlook be appointed, and that he be given full time facilities for research and complete freedom from routine administrative or advisory duties. I would suggest that the appointment be for three years in the first instance. If definite results of substantial economic value, with promise of more, were not forthcoming at the end of that period I should regard it as an indication that the investigation was proceeding on the wrong lines.

The necessary ecological work may be considered under two main headings (*a*) physical and chemical, (*b*) agricultural and biological.

(*a*) *Physical and Chemical Ecology.*– I envisage an investigation on similar lines to that of the Froghopper Committee in Trinidad, with this difference, that under Trinidad conditions all the physical and chemical measurements, surveys and soil analyses were carried out purely for the purposes of the froghopper investigation, whereas in British Guiana, with an active and fully-staffed Department of agriculture in process of organization, much of the more fundamental work of this type would be accomplished in any case and without special reference to Diatraea. It would be the duty of the Diatraea investigator to apply the general data thus acquired to his own special problems, to correlate them with borer surveys and to supplement them where necessary. For this reason it is not yet practicable to suggest anything like a detailed programme under (*a*).

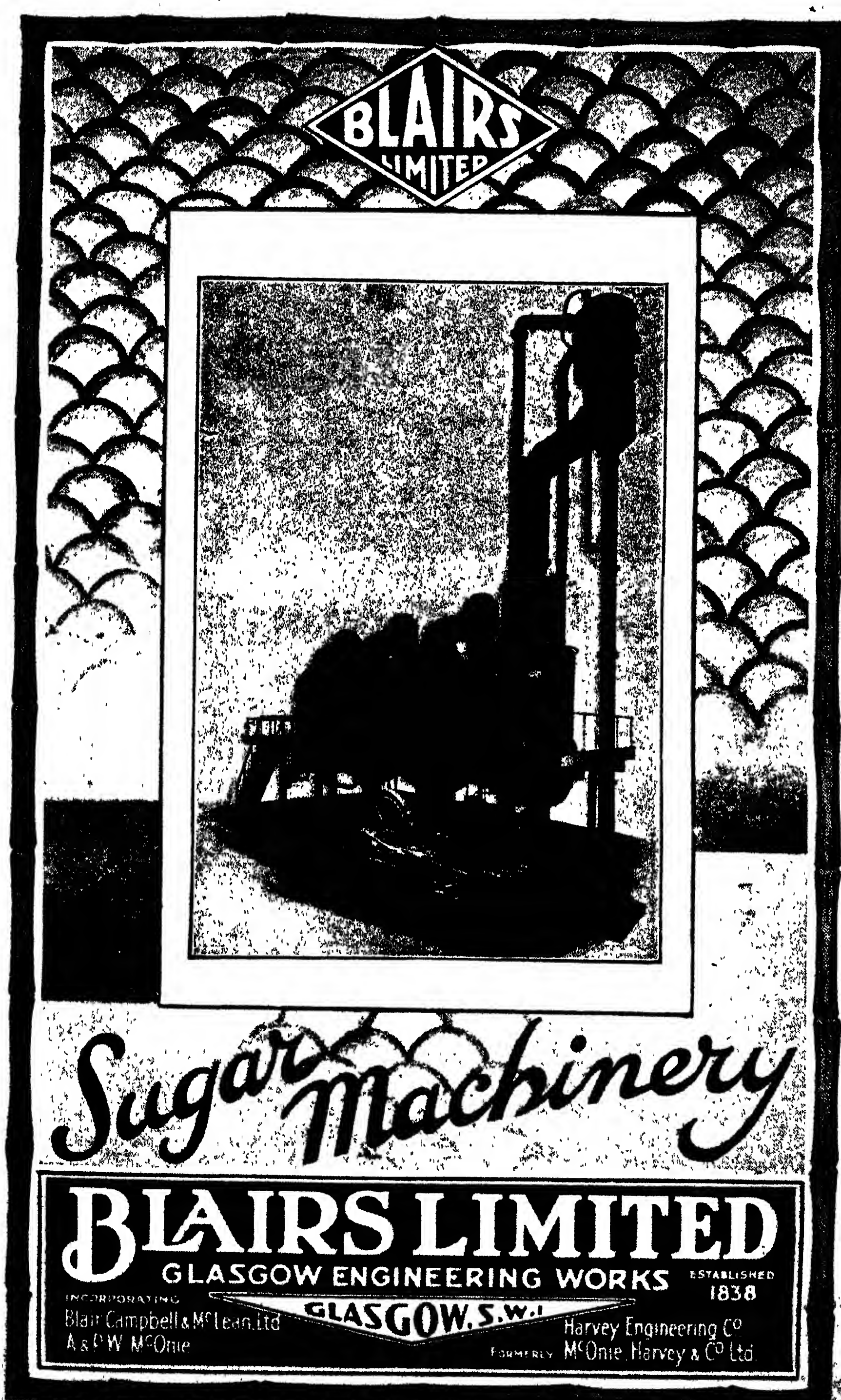
(*b*) Since work under (*a*) depends on the progress of general soil and other surveys by the department as a whole, it will necessarily take some time ; and the Diatraea investigator would therefore concentrate, at least for the first two years, on the purely agricultural and biological aspects.

(1) *Agricultural Ecology.*—The whole of the processes in cane and rice-growing ought to be studied from the point of view of their effect on the borer and on its parasites. This investigation should strenuously avoid mere expressions of opinion, and should base its results on exact quantitative studies of borer infestation and of rate of parasitism at various stages in the growth of the crop.

Much has been written on the bad effect the burning of fields before cutting is said to exert on the parasites—especially on egg-parasites. This depends largely on the rate of effective parasitism ; and no statement made on our present knowledge is much more than a pious opinion. It is essential to obtain exact numerical data.

In addition to ordinary agricultural operations, there is at present a very considerable amount of money spent on *ad hoc* measures against the borer.

[1] From Report of the Director of Agriculture, British Guiana, 1929.


BLAIRS LIMITED
Sugar Machinery
BLAIRS LIMITED
GLASGOW ENGINEERING WORKS
ESTABLISHED 1838
INCORPORATING
Blair Campbell & McLean Ltd
A & P W McOnie
GLASGOW, S.W.1
Harvey Engineering Co
FORMERLY McOnie, Harvey & Co Ltd.

Most estates have at least a borer gang, but some have not, and it is significant that there seems no substantial difference in infestation. It would appear that where the rate of parasitism is below 50 per cent. (and it is usually very much less) the collection and destruction of borers is a sound measure; but in the absence of exact figures as to what *proportion* of the existing borer and parasite population is destroyed, we are really working in the dark.

Then again there is the question of weed-grasses, both on the dam beds and in the canals. Many of these harbour the borer, but in many if not all, the rate of parasitism is much higher than it is in the cane. Several species of parasites which do not attack the borer in cane, parasitize it in these grasses, the flowers of which, moreover, are extremely attractive to several of the adult parasites. This example is given to show the extreme complexity of the problem, and the need for studying Diatraea not only in the two main crops which it attacks, but in its wild hosts and original habitats too.

(2) *Biological Work.*—There are three main species of Diatraea attacking cane in this Colony. These have numerous subsidiary host-plants and are attacked by a large number of different kinds of parasites. It is a striking and significant fact that whereas the infestation of borers is markedly even throughout the Colony, the rate of parasitism by different parasites varies tremendously from one estate to another—so much so that if all the parasites exerted anywhere near their maximum effect on all estates together, the Diatraea problem would cease to exist.

My own contribution to the work will be in the introduction into British Guiana of *new* parasites, which at the worst will merely serve to supplement the work of the native ones, and at the best may lead to reduction of the borer below pest level.

The biological work needed in this country is threefold: firstly, to work out in detail the complex interrelations of Diatraea—plant-host—parasite, outlined above, and to study the effect of the agricultural operations on this balance; secondly, to devise ways and means of assisting artificially the work of the parasites already here; and thirdly, to assist in the establishment of the foreign parasites, introduced by me. In the encouragement of native parasites, it is experiment on a large scale which is needed. The aim should be, especially with the egg-parasites, to secure a rearing and liberation of at least a million a day, and to concentrate this total on a small area where demonstrable substantial and unequivocal results can be expected. When such results can be shown, there will probably be no difficulty in securing the adoption of this technique on all the estates. The cost should be very little more than that already spent on several estates which now keep their own laboratories but do not rear sufficient numbers of parasites to obtain a really marked effect on infestation.

An effort should be made to breed the larval parasites as well, on a very large scale. This is a promising line of work provided the necessity for prodigious numbers be borne in mind.

New Cane Varieties in South Africa.—The Sugar Experiment Station has at length released certain cane varieties for practical trials, and a few tons of CH 64/21 (a Cuban variety from the Government Experiment Station at Havana), POJ 2725, and POJ 2878 have been distributed amongst the planting community. Whether this last variety will succeed in Natal, as it has done in Java, remains to be seen, remarks the *S.A. Sugar Journal*. In Java, the canes are grown under a wonderful system of irrigation, whereas in Natal the canes have to withstand occasional severe droughts which call for a tough exterior capable of resisting the long dry winter periods. But as irrigation is extended in Natal, the soft canes will come to the fore.

Recent Work in Cane Agriculture.

Reports of the Government Sugar Cane Expert for India. T. S. Venkatraman, for the Years 1927-1928 and 1928-1929. *Scientific Reports of the Agricultural Institute, Pusa.*

The work of the cane breeding station at Coimbatore is pursued on lines unfamiliar in other countries, primarily owing to the peculiar conditions in the Indian sugar industry; thus, the dominating factor in the selection of seedlings is hardiness rather than excessively high sucrose content in the juice. This hardiness, besides indicating adaptability to climatic conditions which render the growing of crops of tropical canes impossible, includes resistance to deficiencies in moisture, plant food, and even cultivation such as is needed by tropical canes. And it is noteworthy that, within recent years, this aspect of cane breeding has also become much more generally appreciated in lower latitudes; and some of the Coimbatore seedlings are even finding their way into the cane fields of tropical countries. Interest in the work carried on at Coimbatore is thus gradually extending, not only with regard to the bold introduction of *Saccharum spontaneum* among the selected parents, but also in notable advances in the general technique of raising and selecting the seedlings for testing.

These two Reports are taken together, because considerable portions of their contents have already been dealt with in these columns; and this forestalling, which is due to the courtesy of the authors in providing the writer with advance copies of their research work, limits the matter to be discussed. In the present article, repetition will be avoided as far as possible, by giving the pages in this Journal where subjects have been already noticed.

The Coimbatore method of isolating living arrows for crossing, by artificial rooting of the canes bearing them,[1] has proved completely successful with the thin and medium cane varieities. With thick canes it has been found advisable to increase the rooting zone to three or four joints, and to use bigger pots. The very large numbers of hybrid seedlings raised during the period proved that the setting of seeds in the treated arrows is not adversely affected; and the method made it possible to raise over 10,000 seedlings of a desired cross, with a very high degree of certainty as to the parents.

Influencing the time of arrowing.—There are still difficulties in bringing about certain crosses because of differences in their times of arrowing. Advances have however been made: in noting the influence of the time of planting, in noting retardation in canes planted under saline conditions, and an acceleration by four days induced by smoking the canes for an hour a day during the last two months. It is again suggested that the influence of elevation should be tried with the same object in view.[2] Keeping the pollen viable is in the hands of the Second Sugar Cane Expert, N. L. Dutt, references to whose work are appended below.[3]

Lay-out of nurseries.—A minor improvement was effected in the first ground nursery of seedlings, as follows: long, narrow beds were used, 60 ft. × 2½ ft., and veins of sand were introduced, down the middle of each bed and across it at 2 ft. intervals throughout its length. This method secured more uniform irrigation and drainage, with a marked increase in the vigour of the seedlings. The sand appears to act as a sponge.

Root studies.[4]—Set roots have been shown to be necessary for the development of the shoots of cane cuttings, but different varieties appear to differ in the rates of protrusion of the root eyes. In certain varieties some of the roots are delayed, suggesting a provision against adverse conditions arising during

1 *I.S.J.*, 1927, 362. 2 *I.S.J.*, 1928, 23, 234. 3 *I.S.J.*, 1929, 256, 258; and 1930, 311. 4 *I.S.J.*, 1928, 27, 1929, 360.

the early stages of the plant. In the adult plant, fresh roots are produced in succession in an almost continuous series, thus allowing for adaptations to varying conditions of moisture during growth. In consideration of these facts, it is obvious that the root systems of different varieties and seedlings should be worked out, so as to secure data for agricultural operations and for guidance as to the locality best suited for each cane. As will be seen below, this is no merely theoretical conclusion, but is brought to bear on the study of every kind of cane.

Resistance to pests and diseases.—Hitherto this has been chiefly attained in the seedling work at Coimbatore by a careful selection of known resistant parents ; but the study is now becoming wider, and attention is being directed to structural peculiarities of individual varieties in order to see if any of these peculiarities may be responsible for the resistance. Thus in mosaic, which is becoming increasingly important in India and is, presumably insect-borne as elsewhere, roughness of leaf might act as a deterrent, just as rough leafed cotton plants have been raised to protect them from the attacks of mites. An interesting comparison has been drawn between the smooth leaf surface of Striped Cheribon and the formidable armature on the surface of Glagah leaves.[1]

In India the commonest animal enemies of the cane are rats, jackals, porcupines and pigs, and these chiefly attack the lowest joints. Fencing is too costly for the cultivator, and selection for hard rinds has suggested itself. An implement has been invented to test this hardness in terms of the weight required to pierce it ; and, working with this implement, a Table has been prepared of the resistance offered by the rinds of the cane varieties in the Coimbatore collection, from which the following have been extracted. Keli, an acclimatized thick cane, gave a resistance of 4-5 lbs.; Uba and Chunnee, as types of Indian canes, 7-8 lbs. ; the early Coimbatore seedlings, 8-9 lbs. ; and *Saccharum spontaneum*, over 10 lbs.

Co. 205, a direct cross between *S. spontaneum* and a thick cane, has shown a decided susceptibility to mosaic. This caused some surprise, as the Java results show that crosses with this wild blood in them are generally resistant to mosaic. Investigation has, however, determined that the Java form of *S. spontaneum* differs from the common one in India. Coimbatore was one of the first to employ *Saccharum spontaneum* in its breeding programme,[2] and constant efforts have been made to collect as many forms as possible on the farm ; the number now reached is nine, varying from 2 to over 8 per cent. of sucrose in the juice. And the old suggestion is revived that a definite survey should be undertaken of the forms growing in India.

Morphological descriptions of cane varieties.—This has been recommenced in India with studies and published descriptions of the five Coimbatore seedlings[3] most widely grown at the present time : Cos. 205, 210, 213, 214, 223. The descriptions are designed to enable the cultivator to separate these forms if accidentally mixed, and include the root systems, which it is intended shall be a regular feature in future descriptions, however difficult it may be. Five more seedlings are being studied.

General programme of crossing.—The aim of the cane breeding station has been to replace the indigenous Indian canes with better ones, by raising new seedlings ; and the former Sugar Cane Expert is quoted as writing that this has succeeded " far beyond the wildest hopes " entertained at the start. Now, the cane growers want further improvements and closer adaptation to local conditions, necessitating a wider combination of parents. Two com-

1 Illustrated in *I.S.J.*, 1929, 31. 2 *I.S.J.*, 1931, 8. 3 *I.S.J.*, 1928, 237.

paratively recent Coimbatore seedlings, Co 281 and Co 290, are referred to as supplying this need to a certain extent : they are held to be better than any yet produced. The future programmes of breeding are arranged to include three categories of work : (1) Trials of small batches of seedlings to give information as to the types of seedling to be expected from new combinations ; (2) Large numbers of seedlings from one or two combinations, out of which those of economic value can be selected; (3) In-breeding, as illustrated by the history of Co 205. This seedling has certain defects, although found useful in the Punjab and elsewhere ; and the cross was repeated more than once without improving matters. Large numbers were then raised of selfed seedlings of Co 205, and a few promising ones were selected : the best, Co 229, although superior in juice, had less vigour. Large numbers of selfed seedlings were then raised from Co 229 (over 15,000), and certain of these appear to be of the type required to replace Co 205.

Annual Report of the Agricultural Chemist, **S. J. Saint**, Barbados, 1929-1930.

Besides the manurial experiments referred to in the last number of this Journal, certain results obtained in two other directions appear to be of general interest.

(1) *Analyses of juice as a means of assessing soil deficiencies.*—This correlation, attained as a result of analyses by H. Walker[1] in Hawaii, has been tested for three years in Barbados and does not seem to promise to be of much service. The reasons for this decision are summarized as follows :—

The percentage of potash in the juice of the cane depends very much on variety, and this factor must be taken into consideration. The juice from similar varieties of cane, grown in different years, may vary considerably in composition, especially in respect of phosphoric acid. Manurial trials show that cane growing on soil deficient in potash may have more potash in the juice than cane growing on soil not deficient in this constituent. Evidence has been advanced to show that phosphoric manuring may increase the percentage of potash in the juice. It appears that a deficiency of potash in the Barbados soils has a much greater effect on yield than on the percentage of potash in the juice.

(2) *The economic value of potassium sulphate and potassium chloride as sources of potash manuring in Barbados.*—At present there is little muriate used in the island although the substitution of sulphate by muriate of potash would effect no inconsiderable saving in the manure bill. Barbados produces about 80,000 tons of sugar per annum, which corresponds to about 27,000 acres of cane. If it is estimated that 80 lbs. K_2O is added per acre, it can be calculated that 1929 tons 50 per cent. sulphate of potash, or 1607 tons muriate of potash, would be needed to supply the potash requirements of this area. At the present time, muriate of potash is selling at about $63 a ton and sulphate of potash at $65 a ton on the local market. It can be calculated from these figures that the substitution of sulphate by muriate will save about $24,000 or about £5000 per annum on the potash bill.

An experiment was planned on the A.B.B.A. method of Student with ten replicates of each treatment. The plots received no pen manure but trash was turned in : 134 lbs. nitrogen and 134 lbs. of potash either as sulphate or muriate were given per acre : 30 lbs. nitrogen and the 134 lbs. potash were applied in January 1929, and the remaining nitrogen was applied in July 1929. The mean yields were, for the sulphate and muriate, 36·37 and 35·48

[1] See *I.S.J.*, 1923, 214, 478.

tons of cane respectively, or a difference in favour of sulphate of 0·89 tons; and the difference in per cent. sucrose in the cane was 0·06 in favour of the sulphate, and in quotient of purity of the juice 0·06 in favour of the muriate. Statistical analysis shows that the difference in yields was not significant, and there seems to be no reason why muriate should not be used in Barbados in place of sulphate.

ADMINISTRATION REPORT OF **J. S. Dash,** DIRECTOR OF AGRICULTURE, BRITISH GUIANA FOR THE YEAR 1929.

In dealing with sugar cane the Director gives interesting Tables of acreage, production, export and value received, for about ten years. The salient fact emerges that, while the acreage has steadily diminished, the production has increased : the area planted started at about 70,000, fell in about four years to 57,000-58,000 and remained at about that figure for the remaining seven years. The tonnage of sugar produced varied from year to year, but was 87,000 at the commencement of the period and 117,000 at the close. But, perhaps, we shall get a better idea of these changes if we take the averages of the first five of the eleven year period, and compare them with those of the last five : on this basis, the fall in acreage was from 66,000 to 58,000, while the rise in output was from 95,000 tons of sugar to 111,000. This very satisfactory state of affairs the Director accounts for as follows : since the principal variety grown (D 625) remained the same,[1] the improvement would appear to be largely due to improvements in tillage and field management, in some cases extended practice of water fallowing (keeping old fields for some months under water before re-planting). And he draws the conclusion that in spite of current low prices the status of the industry remains unimpaired, providing ample proof of its suitability to the Colony. The money received for the exported sugar has decreased in about the proportion of 9 to 7 during the past nine years, in spite of its larger quantity : the export of rum has also decreased to a certain extent, but molasses has risen from a negligible quantity to 2½ million gallons.

Meantime, we note that the acreage under rice increased from 40,000 in 1923-1925 to over 50,000 during 1926-1928, and to 63,000 in 1929. Whether this may be a factor in the increased yields per acre in sugar, we have no means of judging, but presumably rice has invaded the lower, waterlogged cane fields and the sugar crop has been shifted further inland where better drainage conditions might be expected. Cleaned rice produced has risen from under 20,000 tons to over 40,000 during the past seven years ; but most of this is used in the Colony, the tons exported rising from about 5000 tons to 14,000 in the same period, with a proportionate increase in value. This staple is the second in importance in British Guiana and has a somewhat close economic relation to the sugar industry.

The cane breeding work in British Guiana has suffered an eclipse during recent years owing to a variety of causes, and it is satisfactory to learn that it is gradually being got under control again. The former seedlings produced have been overhauled ; and sixteen are mentioned, together with BH 10 (12) and SC 12 (4) as being considered worthy of supplementing if not replacing D 625, the standard cane, which although giving good tonnage has a low quality juice. The Agronomist, C. H. B. WILLIAMS, reports that during the arrowing season of 1929 a substantial beginning was made on modern lines, with its laborious observations as to flowering, pollination, anther

[1] It would appear that at the commencement of this period, D 625 occupied about half of the cane area, while at the end it practically embraced the whole.

dehiscence and so on, special attention having been given to hardy Java kinds. A new fertilizing programme has also been initiated at Sophia, and similar experiments have been laid down on some of the estates.

With regard to cane diseases, the Colony appears to be fortunate in being reported to be free from mosaic and gumming, the most serious cane diseases in the West Indies, and no other fungal or bacterial affections have been noted as doing serious damage. "Root" disease, as might be expected, occurs in the form of a withering and drying up owing to poor development and failure of the root system; and it is ascribed to the environmental conditions prevailing. An unduly high magnesium relation to calcium in the soil would appear to be a contributory cause.

As regards pests, on the other hand, the position is not so satisfactory. The cane fields of the Colony have the reputation of being more severely infested with borers of stem and shoot than in any other country. It is estimated that over 90 per cent. of all cane stalks are injured to the extent of 25 per cent. of the joints, and it is difficult to assess the actual losses which, however, must be very considerable. Among the various visits by missions, scientists and those interested in trade, the chief ones concerning the sugar industry were undoubtedly LORD OLIVIER's Commission and the visit of J. G. MYERS of the Imperial Entomological Bureau. A note prepared and left behind for guidance in the treatment of the moth borers of the sugar cane in British Guiana is of sufficient interest to be printed in full elsewhere in this number of the Journal.

SUGAR CANE SEED IN VIZAGAPATAM DISTRICT: ITS IMPROVEMENT. **A. C. Edmonds and S. Sitaram Patrudu.** *Agricultural Journal of India,* Vol. XXIV, Part VI. November, 1929.

Alterations in the times of planting and harvesting canes in any place are beset with many difficulties, and there is little doubt that the industry is sometimes under a disadvantage, because of the propagation of the sugar cane by vegetative means. While the time of harvesting is often of necessity confined to the drier and cooler part of the year, this is not the best time for the young canes to commence their growth; and yet the sets and tops are most easily obtainable then. In the present paper, an instance is given of a harvest in the dry, cool part of the year; and the young canes are with difficulty kept alive till the rains come in June. By multiplying the seed by the "short planting" method till September, and laying down the crop then, with only seven months to run till harvest time, a better and bigger crop of canes is reaped at less cost. Although the local conditions of sugar cane cultivation may not be of special interest to workers in tropical sugar countries, this experiment, with the not inconsiderable local difficulties to be surmounted, may be usefully studied in most places where the time of planting is led captive at the wheels of the factory mill. The results obtained show very clearly the advantages to be gained by confining the growing period of the cane to the months when moisture is most abundant in a dry climate, and letting the canes ripen as this moisture gradually decreases.

The experiment was made at Anakapalle in the north of Madras, and therefore within the tropics, where thick canes can be grown to maturity: the cane used was the well known 247 B (known locally as J 247), which had been cropped for twelve years in the tract. The annual rainfall in this small sugar area is about 35 inches,[1] almost all falling between June and November.

[1] According to the writer's notes the average monthly rainfall of Anakapalle is: 2 ins. and under from December to May, 5-6 ins. from June to October (over 6 in September), 2-3 ins. in November.

Irrigation has to be used throughout the year in this hot climate, but is only satisfactory between July and November when it is provided from river flow ; before and after this period it is eked out from pits dug in the ground to tap the water table, which is unusually high here. There are two kinds of soil used for sugar cane ; a heavy clay formed from the river deposits, where it is grown in rotation with puddled paddy, and sandy loam not so widely distributed where paddy is less frequent.

The local practice is to plant the sets from February till the end of April and reap the crop 10 to 11 months later. After planting it is irrigated "as long as the water lasts," at intervals of 10 to 14 days, until the south west monsoon breaks in June, when there is a better supply of water. Wrapping the canes is practised[1] because of their growth in length and the prevalence of cyclonic storms in the tract. Sets are used, the whole cane being cut up, but as the season advances tops are added : the provision of plant material is a costly matter, as from 20,000 to 25,000 sets are needed for each acre, costing from Rs. 100 to Rs. 120. The irrigation also is expensive, as that from wells is raised exclusively by hand labour ; while the bamboos used for supporting the canes come to Rs. 50 annually per acre, besides the laborious tying of the leaves to them which has to be done from four to seven times as the canes grow.

The innovation which the authors call "short planting" can only be done when paddy does not enter the rotation, for the heavy clay cannot be worked during the rainy season. Sets are put down in February and irrigated on small areas until September, when they are cut up and planted in the fields at the rate of 16,000 to the acre. They start growing rapidly at once, and although they do not reach the height of the locally grown canes, this is an advantage in that they do not need wrapping. There is less borer attack in these canes and no rooting at the base ; and at harvest the weight of canes is even greater. A further advantage of September planting is that it leaves time for a green manuring, fodder or short food crop before planting the canes. A photograph is printed of a short crop of 247 B, 6 months and 10 days old, yielding 30 tons of canes per acre.

Tables are given of comparisons between the local crops and the short crops, founded on 3 or 4 years' results ; in the germination of the seed planted, tillering as deduced from canes per acre, and quality of juice as shown by Brix, sucrose and glucose ratio. The yield has to be judged by weight of canes in the crop, for there is no sugar made here, but only jaggery, and the erratic preparation of this brings in all sorts of errors. The following are the averages struck of the whole series of experiments by the writer : Germination (over 3 years); long crop 44 per cent., short crop 61 per cent. with a difference of 17 per cent.

Tillering (over four years) : number of canes per 3 cents 864 and 982 respectively, with a difference of 13·74 per cent. in favour of the short crop.

Quality of juice (3 years) : Brix 18·95 and 18·83 ; sucrose 16·36 and 16·54 ; and glucose ratio 16·26 and 16·02 respectively.

Yield in canes (4 years) : 1736 lbs. and 2002 lbs. per plot, or a difference of 265 lbs., with a probable error of $\pm$ 37·02.

The authors state that there are considerable areas available in the tract, where this short cropping can be introduced, and the cultivators are beginning to practise it.

C.A.B.

---

[1] A good illustration of wrapped cane, and the effect of a cyclone is given in *I.S.J.*, 1919, 546.

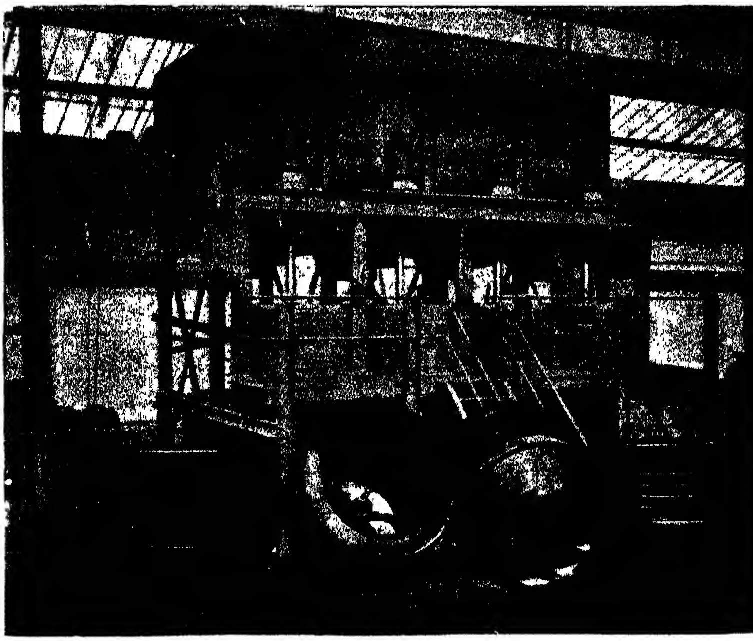
Java Technical Notes.

FILTRATION OF THE WHOLE JUICE IN THE SULPHITATION METHOD OF JUICE CLARIFICATION. **W. C. Nieboer,** *Archief*, 1930, **38**, I, No. 21, 499-505.

One of the typical differences between the carbonatation and the sulphitation methods of working is the filtrability of the juices thus clarified. In the first-named process, both the thin and the thick juices, and also the syrups, can be filtered without any difficulty ; whereas in the second the filtration of the thick-juices and the syrup through cloth is assumed not to be possible, unless use is made of special aids, mostly quite costly, such as the Bach process, or the use of " Hyflo-supercel " or of ordinary kieselguhr. In recent years, however, very many modifications and improvements have been made in sulphitation. Hot sulphuring, for example, has pretty well replaced cold operation, and the addition of the dose of milk-of-lime now almost generally takes place in the sulphiters, simultaneously with sulphuring. Further, the determination of the final reaction in the sulphiters according to the *pH* (using bromthymol blue) and the subsequent control of the juices with this and other hydrogen ion control indicators has led to a more precise manipulation, and altogether has improved clarification. Proof of this is seen in the way in which the sulphitation mud is sweetened off (seldom done at all in former days), now carried out with such success that results are obtained bearing comparison with those achieved in the carbonatation factories. These results, due not only to better processes, but also to much improved plant, have been obtained in spite of the less pure juices treated, caused by more intensive milling.

Surprise, therefore, must be expressed at sugar manufacturers still strongly holding the idea that, using sulphitation, it is impossible to filter the whole juice, and thus retaining the subsiding process with its adherent evils. For the disadvantages of this method are not few. For example, there are heat losses which are such that even in carbonatation, using so much more water for the milk-of-lime and for washing, the fuel control figures are lower. Besides this, there is never any certainty of obtaining an absolutely clear juice, due to floating particles, too light to settle, and too small to be separated by bronze gauze, in addition to which one must not forget the sucrose loss during subsiding and later in working up the muddy juice. All points considered, one cannot doubt that the substitution of filtration for subsiding must constitute a great step forward, and indeed now one should not be resigned to the view that it must be impracticable. It is, in short, a question of sufficient filter-press capacity.

Factories having previously experienced practically no difficulty with their muddy juice filtration would probably find ample a 50 per cent. increase over that required for the mud plus that necessary for the subsided juice. But others may have to consider one or other expedient to assist whole juice filtration. A greater addition of lime, apart from its cost, is not a remedy, besides which one is tied to the existing sulphur oven capacity. Use of "Hyflo-supercel," or of ordinary kieselguhr, to the sulphured juice certainly improves filtration, though it is preferable to use these aids in a more economical way, namely by pre-coating. In a cylindrical tank of 1·5-2·0 cub. m. (330 to 440 gallons) capacity with stirring gear and open coil, about 12 kilos (26 lbs.) of " Hyflo-supercel " per press of 64 sq. m. (688 sq. ft.) filtering area are intimately mixed with juice, and this mixture pumped into the press, using a low pressure, but working as quickly as possible, and coating all the cloths uniformly. In working 15,000 q. (1500 metric tons) of cane giving 2 per cent. or 300 q. of mud, one has 7 q. per press of 64 sq. m.,



so that 300/7 = 43 presses are dressed per day, and therefore 43 × 12 = 516 kilos. of "Hyflo-supercel" are necessary every 24 hours. Hence, with an eye on the cost one must employ this aid only when quite necessary, running a press every now and again without pre-coating to see whether it cannot be dispensed with. Lastly, the writer emphasizes the value of whole juice filtration, not only as being more rapid and economical, but particularly as a means of improving the quality of the white sugar obtained.

Determination of Lime Salts in Cane Juices and Syrups, using Soap Solution. **M. v. d. Kreke and K. Douwes Dekker.** *Mededeelingen van het Proefstation* 1930, 1-11.

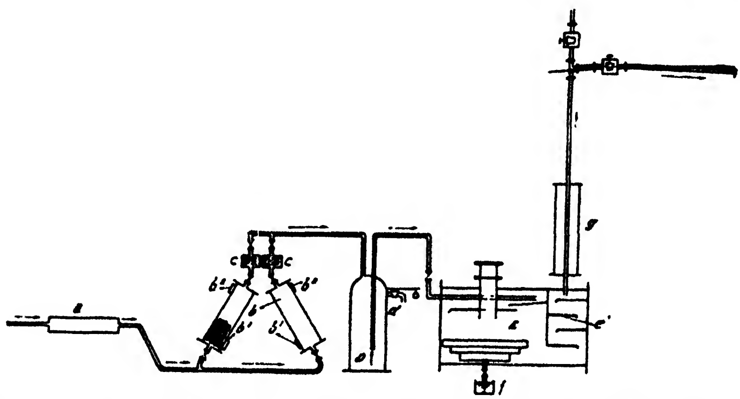
Pellet in 1876 appears to have been the first to apply Clark's soap test to sugar factory products for the estimation of their lime salts; while two years ago Spengler and Brendel made a careful study of the different factors which may affect its accuracy.[1] Following in the main the directions of these two German chemists, the authors have applied the method to factory juices and syrups, and the following is an account of what was done and what was found by them: 20 grms. of potassium hydroxide were dissolved in 200 grms. of 95 per cent. alcohol, 100 grms. of pure olive oil added, and the mixture heated in a water-bath over a reflux condenser till saponification was complete. After transferring to a porcelain basin, the soap solution was diluted with about 3 litres of water; to it was added 5 per cent. calcium chloride solution until a precipitate was no longer formed. This lime soap was washed on a filter till the wash-waters were chlorine-free, and mixed in a mortar with 40 grms. of anhydrous potassium carbonate. The mixture was taken up in 1 litre of 95 per cent. alcohol, heating it in a flask with reflux condenser, then rapidly filtering through a folded paper. The clear solution of potash soap thus obtained was diluted with 3½ litres of alcohol at 70 per cent. Having determined its titre, and found it to be too strong, it was further diluted with 70 per cent. alcohol till 100 c.c. of it were equal to 10 mgrms. of CaO.

In titrating it, a solution containing 4·358 grms. of pure $BaCl_2.2Aq.$ per litre was used, 10 c.c. of this being placed in an Erlenmeyer flask of 300 c.c. diluted with 100 c.c. of water, three drops of ammonia added, some of the soap solution added from a burette, the flask closed with a cork, and then shaken, further soap solution being added until on shaking a layer of froth 1½ cm. high persisted for half a minute. Having so adjusted the strength of the soap solution till 10 c.c. of it = 10 c.c. of the barium chloride solution, titrations were made of factory juices and syrups. So much of these should be taken for accurate results that about 10 to 25 c.c. of the soap solution are required, not more nor less. Generally one takes of raw juice, 100 c.c.; clarified juice, 50 c.c.; evaporator syrup, 5-10 grms.; and of molasses, 1 grm., the product in each case being diluted to a 100 c.c. mark on the Erlenmeyer flask. In an example, 50 c.c. of clarified juice required 10·58 c.c of soap solution, from which one deducts 0·1 c.c. (the amount of soap solution required by 100 c.c. of water plus 4 drops of ammonia, which latter is added to sharpen the end-point) making 10·48 c.c. Using the table by Spengler and Brendel one finds the corresponding number of mgrms. of CaO, say 10·5 for 50 c.c., or 210 mgrms. of CaO per litre. Determinations made by this method using juices and syrups from defecation, sulphitation and carbonatation factories were compared with those found by titrating the calcium oxalate precipitate with standard permanganate, close agreement in general being found, the deviation averaging not more than 10 per cent.

[1] *I.S.J.*, 1929, 91.

MINIMIZING SUBLIMATION IN SULPHUR INSTALLATIONS. **H. F. v. Soest.** *Archief*, 1930, **38**, II, No. 26, 611-516.

In most cases in the air-chest between the air compressor and the sulphur-oven a cock is mounted for the purpose of correcting any excess pressure, but this is more frequently used to regulate the air inlet into the oven according to the quantity of SO_2 required. Either this is done, or the air compressor is slowed down or speeded up, or the cock admitting air to the oven is regulated. But whichever is done the combustion area of the sulphur-oven remains the same, a disadvantage of which is that when the supply of air is restricted one may have an excess of sulphur vapour leading to sublimation with possible stoppage of the piping. It is more rational to use some means by which the combustion area of the oven can be increased or decreased as required, this being done by using trays of three different sizes, namely $0{\cdot}6 \times 1{\cdot}4 = 0{\cdot}84$ sq. m. ; $0{\cdot}65 \times 1{\cdot}45 = 0{\cdot}94$ sq. m. ; and $0{\cdot}7 \times 1{\cdot}5 = 1{\cdot}05$ sq. m. ; the

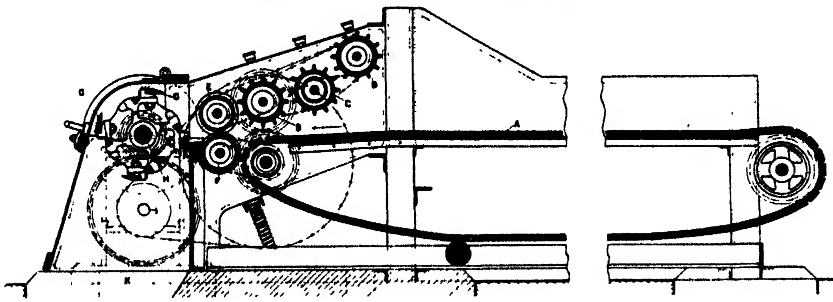


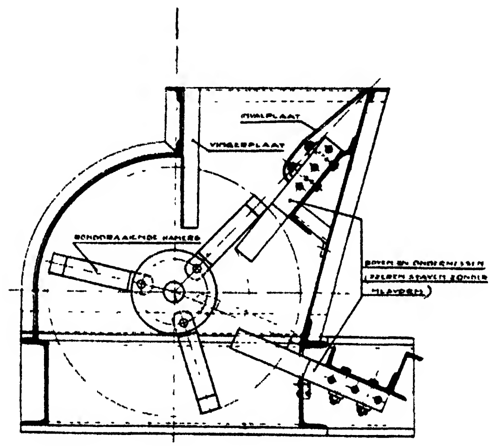
height of the first being 0·07 m., and of the second and third trays each 0·05 m. In practice anyway one can never obtain sulphur dioxide quite free from sulphur vapour, and can only so regulate conditions that the unburnt sulphur is reduced to a minimum. Since the oxidation of sulphur requires time, it is well to endeavour to lengthen the period of combustion by retarding the rate of flow of air through the combustion chamber by means of baffles (as is shown). As soon as the air enters at the top of the oven, it is made to strike a baffle from which it is deflected to another, the idea being to give it more time to heat up before reacting with the sulphur vapour. Then after leaving the combustion chamber the sulphur gases should be passed through a cooler to reduce them to a temperature of say 150 to 200°C., so as to diminish so far as possible the possibility of sublimation in the line between the combustion chamber and the sulphitation tank.

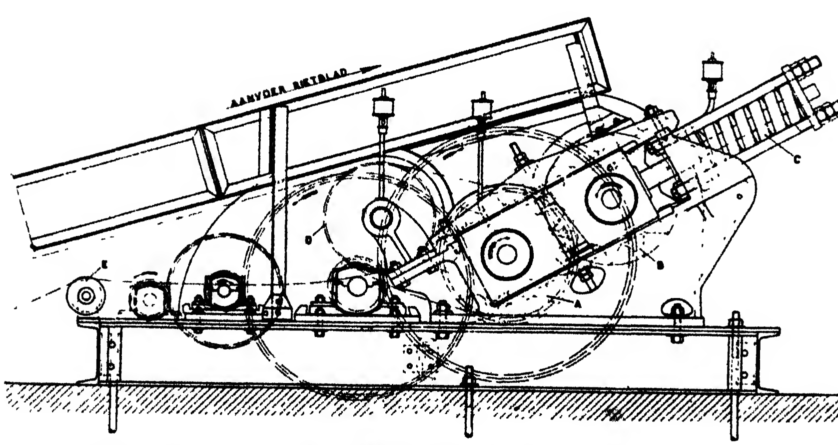
RESULTS WITH TRASH CUTTERS, SHREDDERS, AND CRUSHERS. **E. C. von Pritzelwitz van der Horst.** *Archief*, 1930, **38**, No. 30, 693-700.

In Java three types of apparatus are employed for dealing with cane trash for better suiting it for stoking to ordinary boiler furnaces, namely : (1) cutters, (2) *rafelaars* or shredders, and (3) crushers. In the first of these (see the top figure), the trash is brought along on an ordinary horizontal carrier *A* at the end of which it is crushed by feed-rollers, *B*, *C*, and *D*, being finally gripped by the cylinders *E* and *F*, and sent between the knives *G*, which revolve at great speed, the finished product dropping through the opening *K*. As now used, the capacity of this machine is limited, being seldom more than 40 metric

tons in 24 hours, besides which the knives require renewal after dealing with about 250 tons. On the other hand, their advantage is that they work very effectively, a product being obtained which is especially suitable for mixing







with bagasse for fuel. So called *rafelaars* or shredders on the Held system are used almost exclusively in the H.V.A. factories, and show in their design considerable resemblance to the Searby shredder, as can be seen from the middle

figure here reproduced. One of these machines may have a capacity of 60 tons per day. Its disadvantages are a great dust formation and the less effective sub-division of the cane-leaf, this being cut longitudinally, and in consequence giving a much greater percentage of long strips than do the cutters. Trash-cutters, shown in the lower figure, are due to the initiative of Gempolkrep s.f. in 1922, since when they have proved so satisfactory that a good number have been constructed by a firm of machinery manufacturers in Java. They have 30 in. × 24 in. rollers, and a normal capacity of 60 to 90 tons in 24 hours, or they may be made in a smaller size with 20 in. × 24 in. rollers for a capacity of about 26 tons. This type is shown in the lowest figure herewith. Its construction is simple and strong, the actual apparatus consisting essentially of two toothed crusher rollers, *A* and *B*, and the pressure-regulating gear *C*. With this apparatus the quality of the work is much dependent on regular feeding of the carrier, while dust formation gives less trouble. Regarding the comparative state of division of the material delivered by these three types of trash disintegrating apparatus, the cutters give the greatest percentage of coarse particles and the shredders the lowest, that produced by the crushers being intermediate, being the most uniform of the three. This latter material in fact is very satisfactory; it can be mixed with bagasse, or can be stoked as it is. Such disintegrating apparatus, concludes this writer, may be of greater importance in the future, since the adaptation of a good and cheap material as trash and the like as fuel in bagasse furnaces may become a matter of great interest.

FILTER-CLOTH WASHING, USING RAW JUICE. **E. H. Oosthoek.** *Archief,* **38,** 11, No. 47, 1074.

At the Poerwodadi s.f., a Vallez press is in use for the filtration of the second carbonatation juice. After about three weeks, the press began to run dirty and to slow up, so the cloths were given a wash with dilute hydrochloric acid, being afterwards of course rinsed out with water. But this method of cleaning proved inadequate, stopping up being soon again experienced, and it was necessary to have recourse to a new set. Later, however, another method of cleaning the cloths was put into operation, namely with the use of raw juice. In putting this idea into operation, the cloths were laid on the bed-plate of the mill, for 12 to 24 hours after having been sprinkled by the raw juice. The result was striking. At the end of the time mentioned, the hard crusts had dissolved, and the cloths had become as new; they were no longer stiff, rather were they pliable, and in a much better condition than after the treatment with hydrochloric acid. Not only was an economy effected by this procedure in the consumption of cloth; but there was an absence of corrosion of the press joints formerly observed when packing with cloths which had been cleansed with acid. So far the opportunity has not occurred to wash the cloths of the first carbonatation in this way, the season being at an end, but later it will be tried out, at the author's factory, and it is expected the same satisfactory result will be obtained.

SUGAR PRICE LIMITS IN NEW YORK DURING 1930.—According to Lamborn, the highest price for sugar on the New York Coffee and Sugar Exchange during 1930 was established on January 2nd, when the December, 1930, option reached 2·26 cents per lb. The lowest price was paid on September 30th, when the October, 1930, option was sold at 0·94 cents per lb. The 1930 low price is also the all time low for any option in the history of the Sugar Exchange. The all time high was made on May 19th, 1920, when the July, 1920, option sold at 23·35 cents per lb.

Abstracts of the International Society of Sugar Cane Technologists.

Under the scheme proposed by the International Society of Sugar Cane Technologists, a collection of abstracts of papers on agricultural and technical subjects has now been issued. These deal mainly with beet technology. A selection has been made by us and appears below :—

Beet Sugar Manufacture.

Storage Experiments with Raw Beet Sugars. **O. Spengler and S. Böttger.** *Zeitsch. Ver. deut. Zuckerind.*, 1930, **80**, 690-709.

It was concluded that a raw sugar which has less than 2 per cent. of moisture can be stored at 50 to 60 per cent. of relative humidity without appreciable change in either water content of affinity quality. The optimum relative humidity for low yielding raw sugar was about 54 per cent. ; the optimum for the high yielding sugar was about 59 per cent. The keeping quality of a cooled phenolphthalein-alkaline sugar is mainly dependent on the original character of the sugar and its moisture content. Where the quality of the sugar is reasonably good, and where the relative humidity of the air in the warehouse in maintained at the optimum, the affinability and moisture content remain constant, and attack by micro-organisms proceeds slowly. Keeping quality is practically independent of storage temperatures (10° to 30°C.). Hence it is merely necessary to keep a hygrometer in the warehouse and manipulate the temperature so as to preserve the optimum relative humidity. Some experiments were also made with white sugar. The optimum relative humidity in this case was found to be between 60 and 65 per cent., but here, as also in the case of raw sugar, the results depend on the ash content. This is due to the fact that syrup films of unlike purities and the general composition of the sugar result in different vapour pressures that lead to differences in the equilibria of the three-phase system sugar : syrup film- air moisture.

Experiments on Factory Control. **I. B. Mintz et al.** *Naukovi Zapiski.* 1930, **9**, 213-264.

The chief chemist of the Russian sugar trust and a large staff of assistants made a thorough and detailed study of the operations of the Josepho-Nikolaevsky beet sugar factory with a view to establishing a basis for a complete standard scientific control. Most of this work was directed toward locating and estimating losses of sugar in the process. The sugar balance of the factory for an 80-day run was found to be as follows : sugar in beets, per cent., 17·85; white sugar obtained: in per cent. of beets, 14·66; on 100 sugar in beets, 82·1 ; yield of final molasses, per cent., 3·61 ; total loss, per cent., 3·19 ; known losses : in pulp, 0·56 ; in diffuser water, 0·34 ; in filter mud, 0·28 ; in final molasses. 1·72 ; in condenser water, 0·1 ; total known loss, 2·90 ; and undetermined loss, 0·29. Investigation of diffuser operation proved that extraction is fairly uniform at different levels in the cells. The average yield of wet pulp was 96·2 per cent. when determined by placing samples of cossettes enclosed in nets in the diffuser. The yield of pressed pulp was 83·65 per cent. when diffusing with water alone and 85·12 per cent. when the green molasses was returned to the diffusion battery. Re-macerating the filter-press cake with water according to the method proposed by Claassen yielded no extra sugar. The practical natural alkalinity ranged between 0·014 and 0·021, but was less during the time when green molasses

was being returned to the diffusers. With proper work (high temperature, optimum alkalinity) the juice-boiler performed no useful function in the elimination of lime salts.

TECHNICAL RESULTS AT SOME GERMAN SUGAR FACTORIES. **Dr. Ing. Berner.** *Cent. Zuckerind.*, 1930, **38**, 787-789.

The author summarizes the results of engineering inspections made by the Central German Boiler Inspection Service during the 1929-30 campaign. Data are given on the heat economy of 29 factories, among which may be mentioned the following regarding average heat consumption per 100 kgs. of beet worked by factories having capacities of less than 1500 tons per day (*A*), and those with capacities greater than 1500 tons (*B*) :—

	(*A*) Lignite	(*B*) Lignite	(*B*) Hard coal
Max. (in Kcal)	112,900	86,000	—
Min. ,,	59,200	49,500	—
Aver. ,,	82,300	6,200	55,300

Technical power conditions in these factories have greatly improved in the past few years, especially in those plants where high capacity boilers have been installed. In one completely electrified factory using flue gas for drying pulp the power requirement per 100 kg. beets was 1·89 kilowatts. The most favourable figure for steam consumption so far noted in pressure evaporation was 41·7 per cent., where the heat content of the boiler steam was 568 Kcal/kg. Plants operating with higher pressures and degrees of superheat can effect a saving by reducing to the above figure. The best heat efficiency noted in a pulp dryer was 76·5 per cent. Separate heating of pulp dryers has little or no advantage over heating with flue gas. A sugar factory employing a modern high power turbine can profitably generate excess electric current during the campaign for sale to power lines. In this way the cost of such a turbine may be amortized in two years.

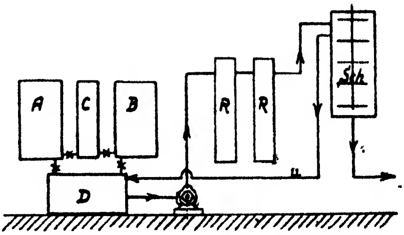
CONDUCTIMETRIC PHENOMENA IN RELATION OF OVER-SATURATION. **K. Sandera and V. Preininger.** *Zeit. Zuckerind. Czechoslov.*, 1930-31, **54**. 115-119.

When raw beet juice is limed and carbonatated (first saturation), the electrometic conductivity of the juice diminishes in proportion as soluble electrolytes are precipitated ; this continues to a certain point, after which some of the precipitated substances go into solution again, due to formation of bicarbonates. When this occurs the electrometric conductivity rises and the juice becomes oversaturated, which is something to be avoided. The point of complete carbonatation and beginning of over-saturation can therefore be recognized electrometrically. The authors report on experiments where small amounts of ammonium salts were added to limed sugar solutions and the electrometric minimum of carbonatation was determined. The effect of the presence of ammonium ions is to lower the minimum so that over-saturation does not occur until the alkilinity has been reduced by carbonatation in some cases 0·04 to 0·05 per cent. CaO or less, depending on circumstances.

WORK WITH THE BLANKE TUBE CARBONATOR. **W. Mohring.** *Cent. Zuckerind.*, 1930, **38**, 1306-1307.

The Blanke tube saturator or carbonatator, which has been in operation for several years at the Walschleben beet sugar factory, continues to give satisfaction and has attracted much attention from German sugar technologists.

The present mode of operating the process is diagramatically represented in the accompanying illustration. The measuring tanks, *A* and *B*, are so connected with the milk-of-lime tank, *C*, that each time a measuring tank is emptied a certain quantity of milk-of-lime is drawn with it. Mixing of lime and juice is effected in the closed vat, *D*, and the limed juice is pumped through the usual raw juice heaters, *R*,*R*, and thence into the tank, *Sch*, in which the liming reaction is completed ; an overflow pipe returns excess juice to the vat, *D*, but usually there is no overflow. No fouling of the heaters has occurred. From the tank the limed juice passes into the saturator, which has the form of a series of long upright pipes throughwhich the juice is pumped, along with a current of carbonic acid gas from the lime kilns. On issuing from the carbonating pipes the saturated juice is received in a sump tank, from which it follows the usual route through the grit catcher and is pumped into the filter press. About two minutes are required for the the juice to pass through the carbonatation pipes; no operating difficulties are encountered; the alkalinity is easily held within 0·02 per cent. CaO, and the utilization of the carbonic acid gas is 30 per cent. better than in the old process of carbonatating in tanks. The filtration is also much better and the press cake is easily and more quickly washed. About 2 per cent. of CaO is used for the first liming. An automatic control instrument registers the alkalinity of the carbonatated juice at 10-second intervals; the apparatus used for this purpose works on the electrometric principle.



MODIFIED METHOD FOR DETERMINING NATURAL ALKALINITY. **I. B. Mintz et al.** *Naukovi Zapiska*, 1930, **9**, 246.

The original method proposed by SPENGLER and BRENDEL for determining natural and residual alkalinity of beet juice is complicated and time-consuming; the abbreviated for msuggested by DUWELL and SOLON is shorter ; and now the authors propose a somewhat more rapid modification of the DUWELL and SOLON method, as follows : A sample of the hot juice from the first saturation filter press is taken in a 300 c.c. cylinder and its temperature noted. The sample is poured into a 600 c,c. Erlenmeyer flask, a few drops of phenolphthalein indicator are added, and a moderate current of carbon dioxide gas is passed through the liquid until the pink colour disappears ; 50 c.c. of distilled water are added to the decolorized liquid, whereupon it is boiled for six minutes over an open flame. The juice is then quickly filtered, returned to the original measuring cylinder, and filled to the 300 c.c. mark at a temperature corresponding to that of the original hot filtered juice. The liquid is then cooled to the ordinary temperature and 200 c.c are titrated with F/5 HCl; the number of c.c. required in this titration, multiplied by 0·056, gives the practical natural alkalinity. The residual lime content is determined by taking 50 c.c. of the saturated and boiled juice, diluting it to 100 c.c. with distilled water, and titrating with soap solution. The number of milligrams of CaO found by this titration is multiplied by 2. The results by this method are somewhat lower than those obtained by the DUWELL and SOLON method, but are sufficiently accurate for practical purposes.[1]

[1] See also *I.S.J.*, 1930, 366 for another simple modification of the Duwell and Solon method.

Optimum Alkalinity for the Final Carbonatation. E. Saillard. *Supp. Circ. Hebd.*, No. 2174, Nov. 23rd, 1930.

The author, who is director of the central laboratory of the French Sugar Syndicate, considers that the methods for determining practical residual alkalinity in beet juice worked out by SPENGLER, BÖTTGER, and DUWELL and SOLON not only are uselessly complicated, but that they do not solve the problem of carrying the necessary degree of alkalinity through the evaporation process. He proposes a method which will imitate factory practice, as follows: Heat a portion of first carbonatation juice in a porcelain or aluminium casserole in a water bath to the same temperature as the juice of the second carbonatation. Pass a current of carbon dioxide through the juice and from time to time remove 30 or 50 cc., filter, add acetic acid and ammonium oxalate, and boil; if any soluble lime is present there will be a precipitate of calcium oxalate. Continue the process until no such precipitate is observed, then determine the alkalinity of the filtered juice by titration. This alkalinity is the alkalinity to be worked to in the carbonatation, provided that this alkalinity will be sufficient to last through the multiple effect evaporators and provide a basis for sulphuring the thick-juice. If not, carbonate of soda must be added to the juice before the second carbonatation, and the same tests repeated. If the factory uses a juice-boiler (or pre-evaporator) the same tests should be made after the juice has been boiled.

Correlation between Colouring Bodies in Beet Crowns and the Sugar Content of the Beet. A. Jurbin. *Jour. Sakh., Prom.*, 1930, **4**, 347-351.

When a cross section is made through the top of a sugar beet just under the stems of the centre leaves there are observed zones of coloured spots in various tints—red, pink, yellow, brown and green. The author finds a distinct negative correlation between the intensity of these colorations and the sugar content of the beets. A method based on this observation is recommended as a better means of selection for breeding purposes than determination of specific gravity by salt solutions. In making the cross sections for the purpose of observing the coloured spots enough of the leaf points are left to enable the mother beet to sprout and produce seed.

Ash Content and Conductivity of Raw Sugar Solutions. O. Spengler and F. Tödt. *Zeitsch. Verein. deut. Zuckerind.*, 1930, **80**, 853-856.

Experiments on 60 German raw sugars has verified the conclusion that electrical ash determination on sugar solutions of low Brix (about 5) is several times more accurate than electric ash determination on solutions of higher Brix content (about 25°Brix.).[1] The method worked out by ZERBAN for correcting for the difference between electric ash and chemical ash, which consists in a second measurement of the conductivity after addition of hydrochloric acid, was found not applicable to the sugars tested by the authors, probably because of differences between the non-sugars of their samples and those of ZERBAN.

Superheated Steam. E. Saillard. *Supp. Circ. Hebd.*, No. 2172, Nov. 9th, 1930.

Various French sugar factories visited by the author continue to find satisfaction in the use of superheated steam at 150°C. for heating the first effect of the evaporating station. The steam enters the heating chamber under a pressure of 1·7 kg. per sq. cm. and thus has 21°C. of super-

[1] See also *I.S.J.*, 1930 159-160.

"Mirrlees"

CANE SUGAR MILL ROLLERS.

The shell of a mill roller is of first importance in the operation of a milling plant—it must be hard to wear well—it must be coarse to feed well, two very opposite characteristics for Cast Iron. "Mirrlees" Rollers have both, they are cast in our own foundry where mould temperature, pouring temperature, cooling time and metal mixtures are accurately controlled.

THE MIRRLEES WATSON COMPANY LIMITED

ENGINEERS SCOTLAND STREET, GLASGOW

London Office - - Mirrlees House, 7, Grosvenor Gardens, S.W.1.

031

heat. The juice in this effect boils at 120°C., and the condensed water has the same temperature as the saturated steam, namely, 129°C. These facts are considered to show that, as regards transmission of heat, superheated steam does not behave like a gas, as is stated in works on general physics.

CANE SUGAR MANUFACTURE.

DETERIORATION OF PHILIPPINE SUGAR AT VARYING DEGREES OF HUMIDITY. **Q. D. Rendon.** *Philippine Agriculturist*, 1930, **19**, 383-396.

Storage of sugar in the Philippines has lately been a serious problem owing to excess production. In a study to ascertain the effects of humidity on the deterioration of brown and refined sugar, small bags of each product were stored in large desiccators wherein humidities ranging from 50 to 100 per cent. were maintained by means of solutions of sulphuric acid of various strengths, analyses being made at the end of 60, 90 and 100 days. Although the data show slight variations, it appears that the moisture content of stored sugar may decrease at humidities below about 66 per cent. At greater humidities, the sugar attracts moisture, thus promoting the growth of micro-organisms which destroy sucrose. The losses thus caused increase with the humidity.

MILL SANITATION AND JUICE DETERIORATION. **R. H. King.** *Sugar News*, 1930, **11**, 640-655.

Some 5000 analyses were made during a three-month period on cane juice at a Philippine mill to determine total acidity, apparent purity, and *pH* for the purpose of ascertaining sucrose losses resulting from bacterial activity. It was found that when juice is allowed to stand for various periods up to 24 hours there is an increase in acidity and a drop in *pH*, an increase of glucose and a drop in purity. The actual acidity of the juice, however, is due mainly to the nature of the cane itself, and hence apparent purity, *pH*, titration acidity, or acidity per 100° Brix, are not in themselves indicators of acidity increase during the milling process ; hence, reliance on a set standard of acidity is apt to be misleading. Chief reliance for mill sanitation should be placed on the use of hot water at 3-hour intervals, periodic removal of accumulations of bagasse and sediment, and the use of deep sloping juice pans and troughs. Periodic thorough cleansing of maceration lines, troughs, and storage tanks is absolutely necessary to prevent development of micro-organisms. The use of lime or chemicals is not recommended, as they are said to be ineffective, expensive, and permit a false security. Ordinarily, no appreciable deterioration takes place within a four-hour period in juices held without treatment.[1]

CANE WINDROWER. **A. W. Dykers.** *Sugar Bulletin*, December 1st, 1930, pp. 5-6.

A windrowimg machine invented by S. A. THORNTON, which was observed by the author to work perfectly in straight cane, cuts and neatly piles two rows of cane at the rate of three to five acres an hour. It consists of a frame mounted on a crawler type tractor the wheels of which straddle two rows of cane. Revolving discs similar to those used on stubble shaving machines cut the canes at the ground level and steel plates direct the cut canes into the middle windrow. Long arms in front of the machine help to keep it in the rows and guide the cane stalks into the discs. A 40 horse power gasoline motor supplies the power. Three men are necessary to operate it, one apiece to raise and lower each disc and one to steer.

[1] See also *I.S.J.*, 1931, 44.

Publications Received.

Tables : (*A*) Brix Tables. (*B*) Massecuite and Syrup Table. Th. J. D. Erlee. (N. V. v/h H. van Ingen). 1930.

(*A*) Moll's tables, largely used in Java, and to some extent elsewhere, were last printed in 1916 ; and now a new edition of them is published. Such in fact has been the revision that one will no longer speak of Moll's, but rather of Erlee's tables. All the figures have been re-calculated, and are now based on the following data : a normal temperature of 27·5°C. ; the true c.c., in place of the Mohr ; and the crystal, instead of " standard muscovado." Available crystal is calculated according to the $S—0·4\ (B—S)$ formula. Further, their lower range is extended, an indication of the more intensive extraction of the last mill juices. They now appear in a handier form than formerly, better arranged, and better printed. Erlee's tables will find general use in Java ; but we think (so carefully compiled and convenient are they) that they will be adopted also to a large extent in other countries. (*B*) In the "Handleiding ten dienste der O.F.C." or " Manuel for Use in Mutual Factory Control," one of the textbooks published by the Java E.S., a method is given for determining the Brix, polarization and Q.P. of syrups and massecuites in which the product is diluted 1 : 5. In this table, which is also compiled by Erlee, for a pol. range of 25-75°, and for a corrected Brix range of 15-20, both determined with the 1 : 5 solution, the polarization and purity of the original syrup or massecuite can be read. As in the case of the new " Moll," they are based on a temperature of 27·5°C. Measuring 70 cm. × 90 cm. (or 27½ in. × 35½ in.), they are intended to be hung on the laboratory wall, in order thus to be readily accessible to all.

Chimie de l'Industrie du Sucre : Manuel Scientifique et Pratique. Dr. O. Wohryzek. Translated from the Second German Edition, by Ad. Jouve ; with a note by D. Sidersky. Illustrated. (Librairie Polytechnique Ch. Béranger, Paris). 1931. Price : 245 fr.

About two years ago we noticed in these columns the publication of the second edition of Dr. Wohryzek's work, the " Chemie der Zuckerindustrie," drawing attention to its valuable features.[1] A French translation of this excellent book is now before us, and it will be welcomed in that language, which no doubt will facilitate the more general perusal it deserves. But this French edition is something more than a direct translation of the original text. It was apparent to anyone reading the German edition that the author had confined himself very much to the literature of his own country and that of Germany, hardly doing justice to Belgian and French investigators, who certainly have richly contributed to the subject. Mr. Jouve in preparing this edition has largely corrected this fault, so that one now finds more adequate treatment of the work of men such as Weisberg, Pellet, Vivien, Sachs or Saillard. One cannot but express admiration at the industry of Dr. Wohryzek and to a less extent of his French collaborator in writing such a book, which places directly before the reader a summary to date of the great volume of literature on beet sugar manufacture and refining. This book is really a valuable one ; and we repeat that something on the same lines, dealing with the cane sugar industry, and with refining as carried on in this country and in America, is greatly to be desired.

Hints on Equipment and Health for Intending Residents in the Tropics. J. Balfour Kirk, M.B., Ch.B., D.P.H., etc. Second Edition. (Ballière, Tindall and Cox, London). 1931. Price : 3s. 6d.

This small book by Dr. Balfour Kirk, Director of the Medical and Health Department, Mauritius, deserves to be widely known. It considers the hygienic problems likely to confront the tropical resident or casual traveller ; and is just the kind of book to place in the hands of persons venturing to the tropics for the first time. Written in a colloquial style in the form of letters to the father of a family, it is full of practical, well-tried advice, clearly and directly expressed. Many, we feel sure, will be grateful indeed to Dr. Kirk for giving the result of so much of his wide experience in the pages of this moderately-priced yet valuable little book.

[1] *I.S.J.*, 1928, 609.

Publications Received.

Enzymes. J. B. S. Haldane, M.A. Monographs of Biochemistry Series. (Longmans, Green & Co., Ltd., London). 1930. Price : 14s.

Prof. HALDANE's book succeeds that by Sir WM. BAYLISS in the same series entitled *The Nature of Enzyme Action*, which work was to some extent a polemic for the view now universally accepted that enzymes are catalysts. Hence to a large extent the present book attempts to build on the ground cleared by BAYLISS. It treats of the influence of enzyme concentration, hydrogen ion concentration and temperature on enzyme action; with co-enzymes, activators, and complements; with the purification and chemical nature of enzymes; and with theories of enzyme action and the classification of enzymes. It is a useful contribution to an absorbing branch of biochemistry, which, in spite of continued lines of attack from different directions, remains very imperfectly understood.

Manual of Sugar Companies. 1930. (Farr & Co., 90 Wall Street, New York). Free.

This is the eleventh annual edition of a manual of sugar companies, issued by a firm of brokers in New York. It reviews 26 leading American, Cuban, Hawaiian and Porto Rican Companies, and gives synopses of over 80 companies operating in various parts of the sugar world, mostly those in which American capital is interested. A number of statistical tables of production, consumption, and prices are included.

South American Handbook, 1931. Edited by Howell Davies. (With Map). (Trade and Travel Publications Ltd., 14 Leadenhall Street, London, E.C.3.). 2s. 6d. net. Post free 3s.

This is the eighth year of issue of a Handbook of over 600 pages, comprising a year book and guide to the countries and resources of Latin-America, inclusive of South and Central America, Mexico and Cuba. It is designed to tell the business man all he wants to know about their trade, products, transport, currency, banking, government, etc. A new feature, an Air Section, has been added, which gives details of all the flying routes.

Hints for Commercial Visitors: (1) To Portuguese East Africa; (2) To Spain; (3) To the Canary Islands. (Department of Overseas Trade. London, S.W.1.).

These are useful Memoranda which have been prepared and issued by the Department of Overseas Trade for the guidance of commercial visitors to the countries mentioned, who are not familiar with the local conditions. Information of a useful kind is given, relating to, e.g., Climate and Rainfall, Clothing, Passports, Routes and Fares, Banking Arrangements, Customs Regulations, Hotels, Railway Facilities, etc. This will greatly facilitate the movements of travellers who are not already familiar with these countries. The D.O.T. is issuing these Hints for a large number of countries, the three above mentioned being amongst the half dozen so far issued. Firms interested should apply direct to the D.O.T.

World Sugar Statistics, 1927-28 to 1930-31. (F. O. Licht, Magdeburg, Germany) Price : RM. 10.

This well known German statistician issues annually a bound set of the leading statistical data of the world sugar industry. The 1931 edition which has just been published covers the past three years and includes estimates of the current campaign. We are given world statistics in their various aspects, with a graph depicting the trend of production; details of five principal exporting countries and of five leading importing countries; a Table showing the consumption per head of population of the principal countries of the world; and finally Retail Prices for sugar in European and the most important overseas countries at 1st November, 1930. As to these last, we note that Italy tops the list for Europe with a price of RM. 1·45 per kilo, Russia being a close second with RM.1·34, while Switzerland is the cheapest at RM. 0·25 per kilo.

Brevities.

LOWER DUTCH DIVIDENDS.—The Amsterdam Trading Company (Handelsvereeniging Amsterdam), one of the largest Dutch-Indian sugar producers, announces an interim dividend of 5 per cent. for 1930, against 15 per cent. last year. For 1929 the total dividend was 30 per cent.

THE NATAL SUGAR CROP.—The latest estimates indicate a still larger sugar crop than anticipated, and the final figures, according to the *S.A. Sugar Journal*, will be somewhere in the neighbourhood of 387,000 short tons, of which it has been decided to export 50 per cent. This will be an increase of about 98,000 tons over the previous season's output of 288,635 tons.

BAGASSE UTILIZATION.—Increasing attention is being paid to the problem of the utilization of bagasse. Patents have recently been taken out by Bagasse Development, Inc., of New York; Vazcane Process, Inc.; Hawaiian Cane Products, Ltd., and Bagasse Products Corporation, of New York. Abstracts of these specifications will be found in our "Review of Recent Patents."[1]

HELLIGE COMPARATOR.—Jean Guillaume,[2] of Martinique, French West Indies, in a paper read before the Association des Chimistes de Sucrerie, Paris, calls attention to the advantages of the Hellige Comparator for use in tropical factories, especially on account of the fact that *tampons* or buffer solutions are no longer necessary when using this apparatus. He points out that it uses discs with coloured glasses, which are unalterable, and ensure accurate results.

RUTHS STEAM ACCUMULATORS.—The Westburn Sugar Refineries Ltd. have just placed an order for a Steam Accumulator with Ruths Steam Storage Ltd. for use in their Greenock refinery. This is being manufactured by Messrs. Cochran & Co., Annan, Ltd., and owing to its size will be transported by sea from the Solway to Greenock. This Accumulator is to be 14 ft. 9 in. diam. by 51 ft. long, will have 7870 cub. ft. capacity, and will be equal to a maximum pressure of 160 lbs. per sq. in.

JAVA FEES FOR ANALYSES.[3]—From a recently published tariff stating the fees (in Dutch florins) charged by the Proefstation for carrying out analyses of various products the following are taken :—Soil moisture, 1·0; phosphoric acid in soil, 5·0; potash in soil, 7·5; electrometric titration curve, 25·0; ammonia-nitrogen in fertilizer or manure, 5·0; free acid in sulphate of ammonia, 1·0; polarization of sugars, 1·5; colour before and after washing a sugar, 2·5; conductivity of a sugar, 1·5; *pH*, ditto, 1·0; sulphite content of sugar, 5·0; molasses, glutose content, 10; invert sugar content of molasses, 2·5; suspended matter in molasses, 5·0; complete analysis of lime 25·0; rate of filtration of kieselguhr compared with a standard grade (as "Hyflo") 2·5; active carbon, decolorizing power, 2·5; water-soluble phosphoric acid in clarifiers, etc., 2·5; etc. Standardization of hydrometers costs 1·0, of flasks, 0·50, of polarization tubes, 0·5 and of Clerget thermometers, 1·0. A polarimeter is cleaned up for 10, a balance for 25, and a refractometer for 10.

QUEENSLAND.—Mr. Norman Bennett said in a recent statement that the efficiency of Queensland sugar mills could be rated next to Java and Hawaii. There were 35 in all; nine over 200,000; 16 from 100,000 to 200,000; and 10 under 100,000 tons. Grinding rates had increased from 58 to 70 tons c.p.h., mills tending more towards Cuban practice, that is, maximum tonnage for economic results. Twenty-one mills sent in returns for the mutual system of chemical control; at least seven were able to operate without extra fuel. By-product utilization is recognized to be not so much a technical as an economic matter, and if bagasse were to be used for boarding manufacture or other idea the mills would have to be paid 12s. per ton plus the cost of converting the bagasse-fired furnaces into coal-fired plus an additional profit. Anyway, the annual requirements of the Commonwealth for boarding would represent only 2·2 per cent. of the total production of bagasse from the Queensland crop. If a prosperous alcohol industry were to be built up, a guaranteed price was essential, this meaning a greater protection against imported spirit.

---

[1] See also *I.S.J.*, 1930, 636. [2] *Bull. Assoc. Chim. Sucr. Dist. France*, 1930, 47, No. 11, 450-454. [3] *Archief.*, 1930, 38, No. 48, 1095-1106.

Brevities.

Better Outlook in the B.W.I.—The latest advices from the British West Indian Islands to the West India Committee indicate that confidence in sugar circles has been partly restored by the guarantee of maintenance of the sugar preference for three years, and that the abandonment of sugar estates on a widespread scale, which some months ago seemed inevitable, has not so far occurred. The position is still, however, one of considerable difficulty.

Sugar Duty Changes.—Since December, Belgium has imposed a surtax of 20 frs. per 100 kilos, leviable in addition to the ordinary Customs duties, on the import into that country of sugar and sugared goods. This tax is in force till the end of August 1931. In Italy the duty on sugar of the first class (i.e., with a yield, in refined, of over 94 per cent.) is increased from 35 to 45 gold lire per 100 kilos, and that on other sugar from 24 to 30 lire. The decree enforcing this will have effect till October 31st, 1931.

Cuban Business Regulations.—It is announced from Havana that legislation is under consideration to establish a Commission to regulate the initiation of new business enterprises in that island. This is designed to prevent the establishment of businesses with the deliberate intention of dissolution within a short time to the prejudice of creditors. A general register of firms will be kept, and due authorization will be required from the Commission before the usual industrial or commercial licence is obtainable by those wishing to start a new business.

Mauritius Sugar Export Duties.—The Mauritius Government has taken steps to remove the special export duty of Rs. 3·60 per metric ton on the sugars of the 1930-31 crop. A further Ordinance makes provision whereby the rate of duty leviable on Mauritius sugar by the Customs Tariff (Consolidated) Ordinance, 1929, is reduced from Rs. 0·32 c. per 100 kilogs. to Rs. 0·02 c. per 100 kilogs., the reduced duty being applicable to all sugars of the 1930-31 crop already exported from the Colony prior to the date of the Ordinance (i.e., October 11th, 1930).

Mauritius White Sugar.—Recently in London the Hon. Roger Pezzani, M.L.C., made an eloquent appeal on behalf of the Mauritius sugar industry suggesting the following as one of the courses of action, besides an increased preference, and a long term loan, that might be adopted by way of assistance : " A re-adjustment of the amended tariff of 1928 that would not penalize our white sugars between 99 and 100° polarization as they have been since 1928, with the consequence that we have stopped making them. The adjusted duty to be, as it should have been ever since 1928, 4/9, instead of the present and unfair 5/10, thus allowing us to go back to our whites, and to get approximately 21/4 per ton more than we are now getting."

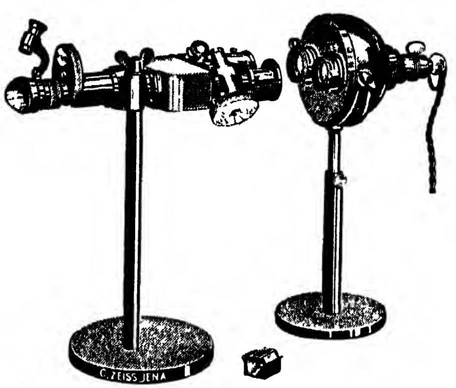
Corn Sugar.—For 25 years it has been required by law in the U.S.A., that when corn sugar is used as an ingredient in prepared foods its presence must be stated on the food label. However, the Department of Agriculture, Washington, has now issued the following ruling : " Corn sugar (dextrose) when sold in packages, must be labelled as such ; when sold in bulk must be declared as such ; but the use of pure refined corn sugar as an ingredient in the packing, preparation, or processing of any article of food in which sugar is a recognized element need not be declared upon the label of any such product. Nothing in this ruling shall be construed to permit the adulteration or imitation of any natural product such as honey by the addition of any sugar or other ingredient whatever."

A Veteran Refiner.—The death is announced at the age of 84 of Mr. William Edwin Criddle, founder and managing director of the Liverpool firm of W. E. Criddle & Son, Ltd., sugar refiners and syrup and treacle manufacturers, who had been associated with the sugar and syrup refining industry for nearly 70 years. More than 50 years ago he started on his own, making old-fashioned black treacle in a small open pan. The business developed till the present refinery premises extend over 5 or 6 acres. In the early days treacle for use in the manufacture of boot blacking was one of the principal articles turned out ; but the modern vogue of polishes has naturally put an end to that source of income, and the firm have since concentrated on the manufacture of golden syrups.

Review of Current Technical Literature.[1]

"Stupho" Graduation Photometer (Pulfrich Photometer). *Communicated to this Journal by Carl Zeiss, Jena.*

What promises to be a valuable instrument for the examination of sugar factory and refinery products has lately appeared on the market, namely the Pulfrich photometer. By means of it, one can examine a product, e.g., a juice or liquor, colorimetrically in the different parts of the spectrum, and can measure turbidity, even when hardly perceptible. It is the outcome of systematic efforts to produce a photometer which should satisfy the requirements of industrial laboratories, and be well adapted for chemical, biological and medical purposes, while at the same time being simpler, and less costly, than the instruments designed for purely scientific investigations. Moreover, it furnishes a direct measurement of the absolute value of the relation of the optical properties of the material under comparison. A series of additional components devised for use with the basic apparatus renders it available in every way as a colour measuring instrument, a turbidimeter, nephelometer, colloidimeter and a comparison microscope.



It comprises a monocular double microscope in which are two objective lenses, through which the two pencils of light to be compared are transmitted later to be combined by prisms in a single field of view within the eye-piece, the latter being focussed upon the line of separation. If both apertures of the telescope be illuminated with the same intensity, and if both diaphragms be opened to their full extent, the eye will see in the eye-piece a uniformly bright field of view divided into two semi-circular halves by a fine line of separation. If now the two substances which are to be compared be introduced (say on one side a cell of the fluid to be tested and on the other a like cell containing optically indifferent water where the absorbing properties of coloured liquids are to be ascertained), the field of view on the side where the absorbing liquid is will appear darker by an amount the magnitude of which is governed by the degree of absorption experienced by the coloured liquid. If now by the rotation of the drumhead on one side (i.e., by reducing the size of the square opening of the diaphragm) the other side be likewise diminished in brightness until both halves of the field of view appear equally bright, the reading of the drum scale will supply a direct measure of the loss which the light has experienced in its passage through the fluid under test within the range of wave-lengths determined by the filter used in the test. The reading gives the value of the intensity of the light transmitted by the sample in terms of percentages of the intensity of the incident light and is universally stated in terms of percentage permeability or transparency to light. The instrument, forms a "colorimeter without a standard solution." Its application as a turbidimeter is based upon the measurable properties of the so-called Tyndall light, i.e., light scattered within imperfectly transparent media. By this means it is practicable to demonstrate the presence of very small traces of a substance in disperse phase in such media, and hence the method is of the greatest value in microchemical analysis. Apart from the application of the method in analytical investigations, it is of great importance in relation to colloid chemistry.

Review of Current Technical Literature.

THE MORGAN CANE DISINTEGRATOR. **Wallace Montgomery.** *Facts about Sugar*, 1930, **25**, No. 28, 786-789.

A method of cane disintegration initiated by the late Col. MORGAN, of Alliance, Ohio,[1] has been developed, and put into operation at Central Hershey, Cuba. It is claimed to do away with the necessity of using crushers, to reduce the power required and to increase extraction. Trials are here described which were made during the 1929-30 crop, when the disintegrator worked in conjunction with a 15-roller Cail mill, preparing 89·1 per cent. of the total amount of cane ground, viz., 391,300 tons. The average grinding rate for the crop was 138·31 tons per hour, the sucrose extraction being 95·38 per cent., as compared with 95·60 per cent. for the previous crop with the same per cent. of fibre in the cane. The lost juice number for the Morgan and mill was 35·76 for the 1930 crop, as compared with 46·98 in a double crusher 5-roller mill of approximately the same capacity. The maceration efficiency number was 20·83, even though trouble was experienced at times in returning all the juice. The moisture in bagasse of 46·45 per cent. was the lowest reported in Cuba for the 1930 crop, and the per cent. sucrose in the bagasse of 2·49 per cent. was also about 0·9 per cent. lower than the average for Cuba. Milling of cane prepared with the Morgan is easily accomplished on ordinary milling equipment with the necessary changes in the grooving of the first mill when very high grinding rates are desired. Due to the finely divided condition of the cane, the penetration and absorption of return juice and maceration water is much better, and there is a decided decrease in the quantity of *bagacillo* returned from the juice strainer, due to the mat packing of the individual fibres. The complete removal of iron was accomplished by a suspended magnet, approximately 400 lbs. being withdrawn from the total crop. Some of the data obtained are as follows :—

POWER CONSUMPTION : KWH PER TON CANE.

Cail Mill and Morgan Disintegrator.

Unit	Crop 1928-29	Crop 1929-30	Operating at close of 1929-30 crop
No. 1 set knives	0·595†	0·505	0.595
No. 2 set knives	0·344†	0·344	0·000
Morgan disintegrator	3·970	2·010	1·570
No. 1 crusher	—	—	—
No. 2 Crusher	—	—	—
Five mills	5·870	7·020*	6·810
Total	10·779	9·969	8·975

† Estimated same as in 1930 season. * Including No. 2 crusher.

COMPARATIVE POWER DATA AND MILLING RESULTS.

	Cail and Crushers 1929-30	Cail and Morgan 1929-30
KWH per Ton Cane :—		
No. 1 knives	0·595	0·595
No. 2 crushers	1·980	—
Morgan	—	1·570
5 mills	5·870	6·810
Total	8·445	8·975
KWH per ton fibre	78·690	82·030
Tons fibre per hour	16·060	16·340
Sucrose extracted per cent. sucrose in cane	94·100	95·380
Bagasse :—		
Moisture per cent.	47·690	46·450
Sucrose per cent.	3·560	2·490

[1] See *I.S.J.*, 1927, 392; 1929, 441.

COMPARATIVE DATA, CROP 1929-30.

	Double crusher and 5 mills		Morgan and 5 mills		Cuban average
Bagasse :—					
Per cent. Sucrose	3·13	..	2·49	..	3·39
Per cent. Moisture	49·04	..	46·45	..	49·51
Per cent. Fibre	46·97	..	50·31	..	46·03
Sucrose :—					
Per cent. Fibre	6·66	..	4·94	..	7·39
Sucrose extracted per cent. sucrose in cane	94·09	..	95·38	..	94·22
Dilution per cent. cane	17·95	..	17·42	..	15·12
Fibre per cent. cane	11·42	..	11·81	..	10·66

PHOTOSYNTHESIS OF CARBOHYDRATES. E. C. C. Baly. *Journal and Proceedings of the Institute of Chemistry*, 1930, **6**, 334-335.

In a recent lecture before the Huddersfield section of the Institute of Chemistry, Prof. BALY discussed some of the results recently obtained by him on the production of carbohydrates by the interaction of CO_2 and H_2O in the laboratory. Although the yields of sugar are still small, he considers the work has a potential economic value and that the commercial production of synthetic sugar is a possibility of the future.[1] The substance of the lecture was as follows :—In all the known chemical reactions the critical increment, that is to say the amount of energy necessary to initiate them, has a maximum value of about 40,000 calories for a gram molecule of the reacting substance. Since the heat of combustion of a gram molecule of glucose is 673,000 calories, it follows that in the photosynthesis of glucose from carbonic acid this amount of energy must be absorbed and that the critical increment is at least 112,300 calories for each gram-molecule of carbonic acid. Since the light corresponding to this absorption was in the ultraviolet (2552 A.U.), it had at first appeared that the formation of sugar by the action of sunlight was theoretically impossible, and the discovery that the reaction in the plant was favoured by light from the red end of the spectrum had made the problem still more confusing. For a considerable time, also, no satisfactory explanation could be given for the fact that the reaction in the plant had a definite temperature coefficient, the formation of sugar being linearly proportional to the temperature up to 36°C., after which the rate rapidly diminished. Early laboratory experiments had shown that carbonic acid absorbed light at 2100 A.U. ; there was definite evidence of formaldehyde, and it was subsequently shown that this was formed by the decomposition of the sugar. Ultimately it was proved that the essential feature of the synthesis was a suitable surface, and by exposing to ultraviolet light substances known to adsorb carbon dioxide (e.g. nickel carbonate), small yields of a syrup which gave all the glucose reactions were obtained. This result had explained the earlier problems ; the energy of activation of the carbonic acid was supplied in two stages, part on the surface and part in the form of light. It has been found that the synthetic reaction was linearly proportional to temperature up to 31°, above which the yield rapidly fell, and close analogy with the plant reaction had thereby been established. It had been proved that the sudden decrease in activity above the critical temperature was due to the fact that 31°C. marked the limit of stability of the adsorption complex of carbonic acid..

Regarding catalysts, nickel carbonate used heretofor had disadvantages; for the best results previous activation by light was necessary, and the powder was only effective for about two hours. Considerable advance had been made by using ferric oxide (containing some thorium oxide as promoter) deposited on aluminated kieselguhr. These powders required no previous activation, and their efficiency varied with the proportion of thorium oxide present ; sharp maxima were observed when the thorium oxide content was about 1·67 per cent. and 2 per cent., with minima on either side of these amounts. It had also been found that their photosynthetic activity was proportional to the magnitude of the electropositive charge assumed, when suspended in water saturated with carbon dioxide. This

1 See also *I.S.J.*, 1928, 8.

observation was of great value, since it enabled the activity of any powder to be rapidly determined. The powders were poisoned by oxygen produced in the photosynthetic reaction, and cataphoresis measurements had made it possible to determine the rates of poisoning and of the subsequent de-poisoning by carbonic acid. When kept in the dark the powders maintained a constant cataphoretic velocity, but when exposed to light the electropositive charge decreased at a rate directly proportional to the intensity of the light. Above a certain definite intensity of light, the powder was completely flocculated and fell to the bottom of the containing vessel. If the irradiation was stopped, the powder was de-flocculated and regained its original maximum electropositive charge. It therefore followed that if the intensity of the light was not too great, the photosynthetic production of carbohydrates became a continuous process. Commenting on the progress which had been made in recent weeks, Professor BALY said that many of the difficulties encountered in earlier work had been overcome. A stage had now been reached where definite and constant results were obtained, and it appeared that complete analogy between the laboratory process and that in the living plant had been established.

RAPID DETERMINATION OF THE TRUE PURITY USING THE CONDUCTIVITY DEPRESSION METHOD. **J. H. Zisch.** *Facts about Sugar*, 1930, **25**, No. 27, 741-745.

At the beet molasses extraction plant of the G. W. S. Co., at Johnstown, Colo., ordinary apparent purities are of no value, because the raffinose increases as the purities decrease, so that one can obtain high and low purity products having an a.p. of 100°. Control has therefore to be based on true purity values, for the determination of which at least 1½ hours are necessary. This report records work that should furnish the foundation for a rapid and sufficiently accurate method of determining the true purity. It is based on the idea of adding the unknown syrup to a very highly dissociated solution of extremely high conductance, and measuring the depression (or reduction) of dissociation caused by this addition. Hydrochloric acid is used for effecting the dissociation of the solution, details of the procedure being as follows : Determine the refractometric dry substance of the syrup under test, and divide the result obtained into 2000 to obtain the grms. of syrup required for the test. Transfer this weight to a 100 ml. flask, make up to the mark with conductivity water, and mix thoroughly. Pipette 10 ml. (representing 2 grms. of d.s.) to a 100 ml. flask, add exactly 10 ml. of HCl (25 ml. of 6 per cent. HCl made up to 1000 ml.). Complete to 100 ml. with conductivity water at 20°C., mix very thoroughly, and determine the resistance in ohms (at 25°C.). Divide the cell constants by the ohms resistance found, and then move the decimal point five places to the right. This gives the conductivity "*A*." Next determine the conductivity of the acid as a blank, using 10 ml. made up to 100 ml., and calculate this as conductivity "*B*."

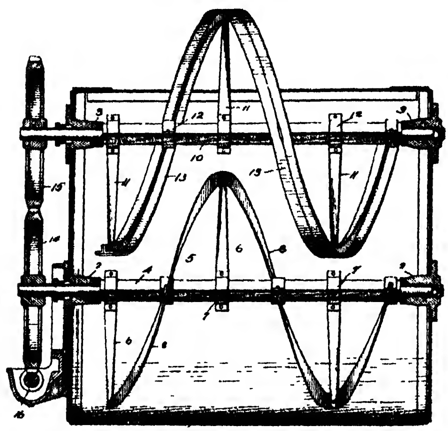
Then $B - A$ gives the conductivity depression (CD). Charts are given plotting CD values with corresponding t.p. values, the relationship being : True purity $= 99{\cdot}0 - (0{\cdot}0832 \times CD)$, though until more general data dealing with syrups from different molasses are obtained this formula should not be taken as a final one. However a molasses was "built up" to thick-juice purity by the addition of pure sugar, and the true purities determined at different steps, using the new method in comparison with routine bench methods, when the results obtained showed the CD method to be as accurate, and certainly very much faster than, the ordinary t.p. methods. It requires only about 20 min. Dr. ZERBAN has made the following remarks regarding it : "This is indeed a novel and most ingenious application of a physical method to follow the elimination of a non-electrolyte constituent from a mixture. As I see it, you use the resultant from three factors, namely, the depressing effect of the non-electrolytes, the depressing effect of the weak acids liberated by the hydrochloric acid, and the additive effect of the highly mobile inorganic ions. As long as the nature of the components does not change, a relative measure of their mutual proportion is obtained, and thus a measure of the true purity. Even if different factories may have to determine their own curves, the method will be an immense help in rapid control work."

J.P.O.

Review of Recent Patents.[1]

CRYSTALLIZER. **William G. Hall** (assignor of one-half to **Roy C. Pitcairn**, of Honolulu, T.H.). 1,769,799. July 1st, 1930.

It has been found in practice that by operating a crystallizer only partly filled with massecuite and permitting the stirring apparatus to operate approximately half in and half out of the liquor, crystallization takes place much more rapidly than when the crystallizer is filled to capacity and the stirring apparatus is completely submerged in the liquor. While this results in expediting crystallization, the advantage is somewhat offset by the reduction in the output of a given crystallizer which is operated at only about half capacity. The present invention is designed to provide a crystallizer of the stirrer type that will maintain the proper circulation of



the liquor in the tank and will also include the advantageous operation of the partially submerged stirrer, which picks up the liquor from the tank, carries the same through the air above or in the upper part of the tank and drops it back in the form of thin sheets or streams into the tank, thereby effecting the rapid and uniform cooling necessary to expedite the formation of the sugar crystals. A relatively simple form of apparatus involving the invention is shown, in which 1 represents the tank of the crystallizer, which is provided with an open top. Journaled in bearings 2, 2 in the lower part of the tank is a horizontal shaft 4 carrying a helical stirrer 8, preferably in the form of a sheet metal strip attached to the shaft at intervals by means of raidal arms 6 and clamping collars 7. Mounted in similar journal bearings 3 located near the top of the tank is a second shaft 10 which carries a second stirrer and liquor elevator, which, as shown, is made of a strip of T-iron or two sections of L-iron connected together to provide relatively extensive surface areas, which, in passing through the liquor, will pick up and carry portions of the liquor into the air above and drop the same in thin streams or sheets back into the tank. The two helical stirrers are so disposed that the successive curved portions thereof intermesh the stirrers rotate and uniform rotary motion is imparted to each by suitable gearing, exemplified in the present case by intermeshing gears 14 and 15 of the same size, the gear 14 being driven by a worm 16. In operating the crystallizer, the tank is filled to capacity, so that the lower helical stirrer operates in completely submerged relation, while the upper stirrer is only partly submerged, so that, as the helical blade rotates, it operates to pick up portions of the liquor, pass the same through the air and drop it in the form of thin sheets or streams back into the tank, with the result that the liquor is rapidly and uniformly cooled and the crystallization of the sugar therein commensurately expedited. Instead of forming the helical portaion of the upper stirrer of a T-cross seection, as shown, the helical member may be formed of a series of spaced parallel blades or strips 13 with their edges normal to the axis of rotation, which will largely increase the lifting and carrying capacity of the stirrer blade and insure the liquor being dropped from the stirrer, as the latter passes through the air in the form of thin sheets or streams, which will still further accelerate the uniform cooling of the liquor.

CRYSTALLIZATION OF SYRUPS AND MOLASSES. **Eloi Ricard** (assignor to **Société Anonyme des Distilleries des Deux Sèvres**, of Melle, France). 1,776,819. September 30th, 1930. In the extraction of sugar by the use of acetic acid, the process which

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

consists in adding to the mixture of the sugar liquid and acetic acid a compound of the class consisting of alkyl alcohols and alkyl acetates whereby inversion of the sugar and of the solution of the saccharose in water and acetic acid are substantially prevented.—POTASH RECOVERY FROM DISTILLER'S WASH. **Karel Cuker**, of Tavikovice, Czechoslovakia. 1,778,381. October 14th, 1930. A process for the treatment of distiller's wash for obtaining concentrated potassium solutions, consists in separating out the suspended matter from the wash in the form of a mass of solid or semisolid consistency by centrifuging, and preparing new mash with substantially all of the so purified liquor, the wash resulting from the treatment of the new mash being in turn centrifuged and the clean separated liquor used for preparing a further new mash, the cycle being repeated until the concentration of the salts in the liquor is so high as to interfere with the normal fermentation process, the concentration of potassium salts being thereby increased and the cost of their recovery reduced.—BEET HARVESTER. **Lewis W. Eversman**, of Julesberg, Colo. 1,781,919. November 18th, 1930. **Ottis M. McGuire**, of Bridgeport, Nebr. 1,781,952. November 18th, 1930. EVAPORATOR. **Harlan W. How** (assignors to **Buffalo Foundry and Machine Co.**, of New York). 1,782,143. November 18th, 1930. A circulator for evaporators comprising an upright conduit having an upper section having a cylindrica wall of comparatively large diameter, an intermediate section having a tapering wall which reduces downwardly from the lower end of said cylindrical wall and a lower section having a flaring wall which enlarges downwardly from the lower small end of the wall of said intermediate section and extends with its lower edge laterally beyond the wall of the upper section ; and a rotary impeller having a conical body arranged below said conduit and axially in line therewith and having its point projecting upwardly into the lower and intermediate sections of said conduit and having its wall flaring downwardly from said point at a distance from the wall of said lower conduit section and forming between the latter and the body of said impeller an annular outlet passage which in radial section is wide at the top and gradually reduces downwardly toward the narrow lower end thereof ; and blades arranged on the upper side said impeller body and in the downwardly reducing space between the marginal part thereof and the inner side of the wall of said lower conduit section.—SUGAR DRYER. **David K. Richards**, of Hilo, T.H. 1,782,177. November 18th, 1930. A sugar drying apparatus comprises a hopper, a rotary shaft within the hopper, a disc, fixed upon said shaft, and means for introducing heated air into the hopper including a funnel shaped nozzle disposed in concentric relation with respect to the shaft and position below the said disk, an inverted frusto-conical member nesting within said funnel shaped nozzle in circumferentially spaced relation therewith and being fixed to said shaft, said nozzle and frusto conical member being of such relative spacing at their larger upper ends as to provide a continuous vertically discharging air outlet of annular extension and having their respective side walls of such inclination as to direct the heated air in a solid annular wall to the periphery of the said disc.—ROTARY CANE CUTTER. **Alfred M. Simpson**, of Manila, P.I. 1,780, 247. November 4th, 1930. A rotary cutter comprises a hub having a peripheral flange provided with a plurality of rectangularly-formed knife-receiving grooves extending radially thereof, knives comprising blade sections, and rectangularly-shaped butt sections adapted to fit into said grooves, the butt sections being of greater length than the depth of said grooves and projecting above said flange, a collar fitting the hub and contacting the projecting faces of said knife butts, and individual bolts traversing the flange, knife butts and collar, for locking the butts in the grooves, and multiple bolts for locking the collar and hub together.—PURIFYING USED YEAST. **Gustave T. Reich**, of Drexil Hill, Pa. 1,783,521. December 2nd, 1930. The art of refining yeast that has been contaminated by its use in producing the fermentation of saccharine materials, comprising diluting this contaminated yeast, separating the same by sedimentation into an upper portion containing yeast of higher protein value and a lower portion containing yeast of a lower protein value and also the impurities collected in the contaminated yeast during said fermentation, and separately collecting and de-hydrating said portions.—TREATING SACCHARINE FLUIDS. **Leonard Wickenden** (assignor to **John J. Naugle**, of Rye, N.Y.). 1,783,551. December 2nd, 1930. The method

of inverting sucrose-containing fluids is claimed, which comprises the step of adding thereto a mono-saccharide syrup containing invertase therein.—MAKING CRYSTALLINE DEXTROSE. **Wm. B. Newkirk** (assignor to **International Patents Development Co.**, of Wilmington, Del.). 1,783,626. December 2nd, 1930. Improvement in the method of making anhydrous dextrose from a water dextrose solution which consists in crystallizing normal anhydrous dextrose crystals from a water dextrose solution containing 93 per cent. or higher of dextrose without the addition of seed, and maintaining the crystallizing magma at a temperature favourable to the formation of the anhydride and in movements so as to effect a uniform dispersion of the solid phase dextrose throughout the same.—BONECHAR DRYER. **James Hamill and J. F. Taddiken**, of New York. 1,784,626. December 9th, 1930. A pre-dryer for a char revivifying apparatus including in combination a chamber, means for feeding char downwardly therethrough, a plurality of spaced apart heating flues adapted to divide the downwardly travelling char into a plurality of thin streams, fins extending from said heating flues to define passages for air currents, and means for passing external air through the chamber in intimate contact with the char for the purpose of removing the evaporated moisture and gaseous impurities.—DIFFUSION PLANT. **Charles Camuset**, of Bretigny-sur-Orge, France. 1,782,603. December 25th, 1930. In a diffusion plant, a receptacle for the material to be exhausted, a number of substantially vertical diffusers, means whereby the said material is circulated through said receptacle and said diffusers in a continuous manner and in one direction from said receptacle to the last diffuser, means for feeding exhausting liquid in the last diffuser at the exit end of said material, connecting means between the diffusers and between the first diffuser and said receptacle adapted to allow said exhausting liquid to flow successively in a continuous manner from the last diffuser to said receptacle and in an opposite direction to that of said material in each diffuser and in said receptacle, and means for regulating the level of liquid in said last diffuser in this diffusion plant. CANE HARVESTER. **Edward Murphy**, of New Orleans, La. 1,774,450. August 26th, 1930. A cane harvester includes a vehicle having endless tracks, means for driving said tracks, a supplemental frame pivoted on the vehicle, ground-engaging means for movably supporting the forward portion of the supplemental frame, stalk-cutting means carried by the forward portion of said frame, conveying means also carried by said supplemental frame for receiving the stalk from the cutting means, and selective topping means carried by the supplemental frame above said conveying means.—FILTER CASING. **Ernest J. Sweetland**, of Hazleton, Pa. 1,774,044. August 26th, 1930. A method of operating filters consists in placing a self-contained continuous filter having an independent mounting within a separate casing and surrounding said filter with compressed air during its operation.—MOLASSES AND CEREAL PRODUCT. **John C. MacLachlan**, of Chicago. 1,774,802. September 2nd, 1930. The process of producing a dried molasses product which consists in cooking a ground vegetable material with water, mixing molasses with a lesser quantity of said cooked material and disintegrating and projecting said mixture in a heated gaseous medium to rapidly dry the same and form a dry powdered material. AFFINING AT HIGH CENTRIFUGAL SPEED. **Julien Bergé** (assignor to the **Raffinerie Tirlemontoise Soc. Anon.**, of Tirlemont, Belgium). 1,775,385. September 9th, 1930. Claim is made for the process of refining sugar, which comprises applying to sugar with adhering mother-liquor a centrifugal force sufficient to overcome the surface adherence of the mother-liquor and the crystals in the absence of a washing agent.—ALCOHOL MOTOR FUEL. **Clay M. Hudson**, of Manila, P.I. 1,775,461. September 9th, 1930. A motor fuel comprises a mixture of alcohol, castor oil, ether and aniline oil.—CURING MASSECUITE. **Julien Bergé**, of Tirlemont, Belgium. 1,784,982. December 16th, 1930. A process for increasing the yield of sugar crystals from any kind of massecuite comprises boiling the massecuite, cooling to a pasty condition, and then separating the mass into sugar crystals and syrup by means of a centrifuge, in which the centrifugal force is considerably more than 800 times the weight of the mass to be separated.

UNITED KINGDOM.

MASSECUITE CRYSTALLIZATION. **R. Haddan** (communicated by **Frank L. Allan,** of New York). 335,022. August 16th, 1929.

Fig.1 shows a crystallizer of well-known type, consisting of a tank with stirring arms 4. According to the present invention, there is combined with the old elements the cooling coils 5, shown also in Fig. 2. Each cooling coil 5 is in the form of a pipe bent to form parallel horizontal limbs connected by return bends and disposed at regular spaced apart levels from the top to the bottom of the tank, the lengths of the different limbs being such that each extends at its ends nearly to, but not into contact with the side walls of the tank. Each cooling coil receives a suitable cooling fluid, ordinarily water, at one end from a supply pipe 6 and discharges at its other end into a drain pipe or gutter 7 which carries the discharged water to waste, or to a cooling tower or reservoir according to plant requirements. The aggregate amount of cooling fluid supplied to the different cooling coils 5 may be regulated by a throttle valve 9 in the pipe 6 at the inlet side of its connexions to the coils 5. With a suitable cooling liquid supply, temperature and pressure and such adjustment of the valves 9 and 10 as may be required, it is possible to have each cooling coil exert any desired massecuite cooling effect. The distribution of the coil cooling effects over planes alternating with the planes of rotation of the stirrer arms 4 and all the way across the tank permits, in practice, of substantial uniformity in the cooling effects exerted on different portions of the massecuite. In consequence of the uniformity with which the massecuite is cooled, heat may be if desirable abstracted, particularly in the initial portion of the crystallization process, at a rate much more rapid than has heretofore been possible without risk of over rapid local cooling, which, in the case of a highly saturated massecuite, presents a certain danger of forming a false or microscopic grain. By the use of the invention, it is possible to have the crystallization process proceed continuously and without interruption throughout the entire crystallization period, and there need be no more interruptions in the formation of crystals such as have been experienced heretofore as a result of the fact that after a certain comparatively rapid crystallization occurs while the massecuite is at one temperature, crystallization practically ceases for a period of hours or even days during which the massecuite slowly cools down to a lower temperature at which crystallization process in practice results in a less thorough exhaustion of crystals from the mother-liquor than is possible when the crystallization process is continuous, as is made possible by the removal excess heat as provided for by the present invention, particularly when the excess heat is removed within a relatively short time after the massecuite is initially dropped from the vacuum pans into the crystallizer. Tanks of other shapes may be used, as e.g. that shown in Fig. 3.

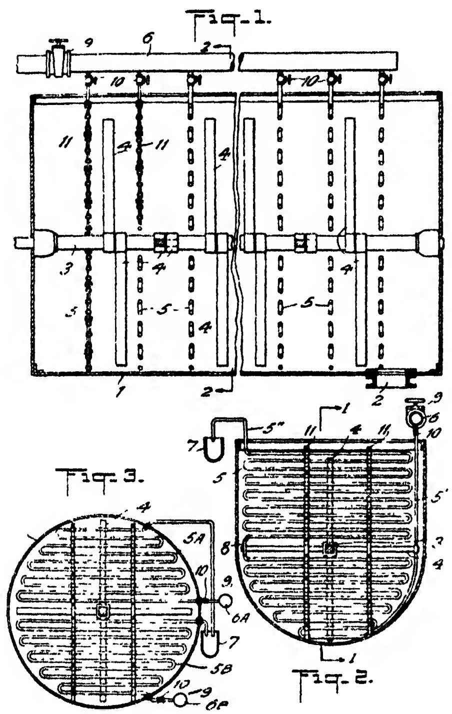


Fig. 1. Fig. 2. Fig. 3.

Sugar Crops of the World.

(*Willett & Gray's Estimates to January 29th,* 1931.)

	Harvesting Period	1930-31. Tons.	1929-30. Tons.	1928-29. Tons.
United States—Louisiana	Oct.-Jan.	175,000	178,223	117,905
Porto Rico	Jan.-June	750,000	773,310	530,116
Hawaiian Islands	Nov.-June	850,000	856,222	844,462
West Indies—Virgin Islands	Jan.-June	2,000	5,736	3,796
Cuba	Dec.-June	§3,570,000	4,671,260	5,156,315
British West Indies—Trinidad	Jan.-June	75,000	79,848	89,926
Barbados	„ „	38,000	58,700	66,275
Jamaica	„ „	60,000	64,697	58,450
Antigua	Feb.-July	17,000	18,550	10,945
St. Kitts	Feb.-Aug.	16,000	18,701	13,724
Other British West Indies	Jan.-June	6,000	6,500	7,494
French West Indies—Martinique	Jan.-July	38,000	37,534	37,550
Guadeloupe	„ „	28,000	24,609	4,000
San Domingo	Jan.-June	365,000	360,259	354,085
Haiti	Dec.-June	19,000	18,907	12,497
Mexico	„ „	200,000	209,730	179,124
Central America—Guatemala	Jan.-June	33,000	35,000	21,055
Other Central America	„ „	50,000	58,000	52,719
South America—				
Demerara	Oct.-Dec. and May-June	115,000	117,254	116,578
Surinam	Oct.-Jan.	12,000	12,500	15,178
Venezuela	Oct.-June	20,000	22,000	19,643
Ecuador	June-Jan.	20,000	19,196	22,400
Peru	Jan.-Dec.	412,000	415,000	361,745
Argentina	May-Nov.	381,562	340,479	375,329
Brazil	Oct.-Sept.	525,000	600,000	737,822
Total in America		7,777,562	9,002,215	9,209,133
British India	Dec.-May	2,850,000	2,766,000	2,735,000
Java	May-Nov.	2,908,000	2,894,879	2,939,164
Formosa and Japan	Nov.-June	925,000	926,255	903,632
Philippine Islands	„ „	750,000	762,074	740,987
Total in Asia		7,433,000	7,349,208	7,318,783
Australia	June-Nov.	515,000	530,483	534,383
Fiji Islands	„ „	90,000	87,680	98,683
Total in Australia and Polynesia		605,000	618,163	633,066
Egypt	Jan.-June	90,000	98,303	108,952
Mauritius	Aug.-Jan.	225,000	238,030	247,752
Réunion	„ „	50,000	51,020	37,699
Natal	May-Jan.	335,000	266,638	264,285
Mozambique	May-Oct.	80,000	93,500	89,780
Total in Africa		780,000	747,491	748,468
Europe—Spain	Dec.-June	10,000	13,562	11,610
Total cane sugar crops		16,605,562	17,730,639	17,921,060
Europe—Beet sugar crops		10,449,100	8,244,801	8,469,491
United States—Beet sugar crop††	July-Jan.	1,050,841	901,713	938,640
Canada—Beet sugar crop††	Oct.-Dec.	39,000	27,869	28,857
Total beet sugar crops		11,538,941	9,174,383	9,436,988
Grand total Cane and Beet Sugar	**Tons**	**28,144,503**	**26,905,022**	**27,358,048**
Estimated increase in the world's production	„	1,239,481	*453,026	2,039,030

* Decrease. †† Refined Sugar.

§ Under proposed Government restriction.

United States.

(Willett & Gray).

(Total of 2,240 lbs.)	1931 Tons.	1930 Tons.
Total Receipts, Jan. 1st to Jan. 24th	116,728 ..	141,486
Deliveries ,, ,, ,, ...	107,155 ..	183,949
Meltings by Refiners ,, ,, ...	120,500 ..	174,243
Exports of Refined ,, ,, ...	500 ..	1,500
Importers' Stocks, Jan. 24th	185,465 ..	394,808
Total Stocks, ,, ...	257,896 ..	564,108
	1930	1929
Total Consumption for twelve months	5,599,377 ..	5,810,980

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT DECEMBER 31ST.

(Tons of 2,240 lbs.)	1928. Tons.	1929. Tons.	1930. Tons.
Exports	3,728,618 ..	4,666,944 ..	3,051,674
Stocks	124,403 ..	181,460 ..	687,056
	3,853,021 ..	4,848,404 ..	3,738,730
Local Consumption	68,857 ..	98,362 ..	76,185
Receipts at Ports to December 31st ..	3,921,878 ..	4,946,766 ..	3,814,915

Habana, December 31st, 1930. J. GUMA.—L. MEJER.

Beet Crops of Europe.

(Willett & Gray's Estimates†† to January 29th, 1931).

	Harvesting Period	1930-31. Tons.	1929-30. Tons	1928-29. Tons.
Germany	Sept.-Jan.	2,500,000	1,966,782	1,851,263
Czecho-Slovakia	Sept.-Jan.	1,175,000	1,022,116	1,055,570
Austria..........................	Sept.-Jan.	150,000	120,375	107,322
Hungary	Sept.-Jan.	225,000	246,496	220,062
France	Sept.-Jan.	1,160,000	909,622	904,047
Belgium	Sept.-Jan.	275,000	252,048	279,290
Holland	Sept.-Jan.	300.000	264,871	319,937
Russia and Ukraine	Sept.-Jan.	2,000,000	950,000	1,446,000
Poland	Sept.-Jan.	770,000	928,757	756,839
Sweden	Sept.-Dec.	180,000	121,404	160,860
Denmark	Sept-Jan.	165,000	134.300	159,492
Italy	Aug.-Oct.	415,000	440,822	391,684
Spain	July-Feb.	310,000	273,955	266,246
Switzerland	Sept.-Jan.	6,500	5,800	7,300
Bulgaria	Sept.-Jan.	55,000	41,007	29,870
Roumania	Sept.-Jan.	150,000	82,230	131,774
Gt. Britain and Ireland†	Sept.-Jan.	453,600	311,074	213,708
Jugoslavia	Sept.-Jan.	100,000	131,639	128,840
Other Countries	Sept.-Jan.	59,000	41,503	39,387
Total in Europe		10,449,100	8,244,801	8,469,491

† Refined Sugar.
†† European Beet Crop Figures are furnished principally by F. O. Licht.

United Kingdom Monthly Sugar Report.

Our last report was dated 9th January, 1931.

Although Mr. Chadbourne has concluded his work in Europe and returned to New York, markets have continued in an unsettled state owing to the fact that the Dutch Government have so far not given their consent to Java entering the Chadbourne plan.

The latest news from Holland, however, is that an association representing the producers has been formed to negotiate with the Government, and it is generally believed that when Mr. Chadbourne returns to Europe at the beginning of next month all countries will ratify the Agreement.

The London Terminal Market has sagged during the period under review and the liquidation of March has caused a considerable fall in the price of this month. March sold from 6s. 2d. to 5s. 6¾d. to 5s. 8½d., May moved from 6s. 4d. to 5s. 11d. to 6s., August fell from 6s. 7d. to 6s. 2½d. to 6s. 3½d., December moved from 7s. to 6s. 6½d. to 6s. 7½d. The latest prices are :—

	MARCH		MAY		AUGUST		DECEMBER
Raw	5s. 8½d.	..	6s. 0d.	..	6s. 3d.	..	6s. 7d.
White	7s. 0d.	..	7s. 3d.	..	—	..	—

The demand from the trade has been very poor and the sale to the refiners has been slow. The Refiners have reduced their prices by 3d. on the 22nd January, and 3d. on the 4th February, their latest prices being No. 1 Cubes 23s., London Granulated 19s. 4½d. The Home Grown Factories moved their prices in sympathy with the Refiners.

Business in Raws has been confined to parcels of 96 per cent. cane and business has been done from 6s. 3d. to 5s. 10½d., but the principal supply to the Refiners during the period under review has been Continental Beet, both German and Polish having been sold to the Refiners and Home Grown factories at 5s. 9d. to 5s. 6¾d. c.i.f.

The American Refiners still have no offers from Cuba, and their wants are being supplied from Porto Rico and the Philippines at the moment.

Cuba still holds off from the market and the only fresh news with regard to the Island is that the crop in all probability will be limited to 3,122,000 tons.

There is no fresh news with regard to Europe, but some 140,000 tons of Russian has been sold to India at a much lower price than the Java quotations.

21, Mincing Lane,
London, E.C.3.
10th February, 1931.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 387. MARCH, 1931. VOL. XXXIII.

Notes and Comments.

The Outlook for the Chadbourne Scheme.

In spite of the doubts of the diminishing band of pessimists (belonging mostly to the middlemen of the industry) the Chadbourne scheme of world restriction of sugar sales is coming to fruition; one fence after another has been safely surmounted since the opening negotiations around Christmas, and any doubts as to whether Java would enter the pact may now be set at rest by the announcement that the local Government in that island has introduced a Bill into its parliament to set up the machinery for carrying out the provisions of the restriction scheme. Messrs. CZARNIKOW, who have all along been cautious in expressing a view as to the outcome of the negotiations, are now able to report that there is continued evidence of an underlying feeling of confidence that the more distant future may hold prospects of a steadily improving trend in sugar values. The sugar market has not responded as yet to the feeling by any hardening of prices, but it is something gained that there has not been a further fall in prices, considering that the gross production of the world sugar industry for the year 1930-31, according to LAMBORN, indicates an increase in sugar stocks of 1,542,000 tons, as compared with those of last August. But for the Chadbourne scheme which will segregate at least two million tons of the current production and stocks, the outlook for economic production would look blacker than ever.

Mr. CHADBOURNE has now returned to Europe, after a visit to Cuba where he has dealt, apparently successfully, with the difficulties which had arisen in connexion with the allocation to individual Cuban mills of the reduced export quotas. According to the latest reports, a Conference is to be held at Cannes within the next few weeks when the participants in the pact will carry out the final ratifications and organize the permanent commission which is needed to supervise the working of the scheme. This commission, according to Mr. CHADBOURNE, will formulate a programme for stabilization by obtaining the co-operation of the less important exporting countries. It will, inter alia, study the possibilities for increased consumption by finding new uses for sugar and increasing its demand as a food in countries, like China, where at present little sugar is consumed.

One of Mr. CHADBOURNE's strongest arguments in the course of his negotiations has been to point out that the general tendency to over-production in the world's staple industries has been responsible for the unprecedented world-wide wave of unemployment which is harassing all sections of industry. As this view is being increasingly realized, there is a greater willingness being shown by producing industries to come to terms amongst themselves; and sugar apparently is not the only commodity to arrange to agree with its adversary; tin seems to have stolen a march on us, for a tin restriction quota has been arranged within the last few weeks and has received the qualified approval of the Governments concerned. And apparently the Chadbourne negotiations with Dutch sugar industrialists have had their repercussion on Dutch rubber interests, for there are circumstantial reports of another attempt to get Anglo-Dutch agreement to a rubber restriction scheme. The tropical producer will welcome all these endeavours to put an end to uneconomic prices that deprive producing interests of their just reward. The more commodities there are that arrange an understanding, the sooner and the more completely will the vicious circle of over-production and low prices be broken.

Europe's Share in the Pact.

It may be said that it is Europe that leads off in the working of the restriction pact, for apart from the agreement of her participating countries to segregate certain quantities of the current production, the question of her share in the 1931-32 crop has to be decided within the next six weeks. The sowings for the 1931 beet season are now a matter for speculative guessing. CZARNIKOW reports that tentative forecasts envisage an actual reduction in the sowings which may amount to as much as 15 or 20 per cent. (The same authority also reports the possibility of a 20 per cent. decrease in the American beet sowings). This probable reduction would naturally result from the conviction of the European sugar manufacturers that they have nothing to gain by producing an excess of sugar which has to be exported at a price which shows them not merely no profit but a considerable loss. The position is perhaps best illustrated by the paradoxical action of certain German sugar manufacturers who have arranged with their growers to sow less than the agreed acreage to beets, but while the latter grow other crops on the surplus land, the manufacturer will pay for the beets not raised on that land, it being cheaper to do so than to face the loss on the export of the sugar that would have been produced. The tendency everywhere, except perhaps in Russia, will be to reduce sowings: to what extent must depend on the course of sugar market prices during the next two months. Indeed, it is said that the Chadbourne scheme will be best served if the price of sugar clings to its present low level till after the beet sowing season. Thereafter, any rise will not affect the beet sugar output of the 1931-32 campaign. Russia remains the dark horse, and her recent exports east of Suez have somewhat alarmed the market. Mr. CHADBOURNE professes to be satisfied with the course of his negotiations with Russia, though German opinion inclines to the view that he has been too boastful in the matter and that reports from Russia suggest that the authorities there have no intention of being bound in any way. However, money is Russia's greatest need and any offer of facilities for credit in America might alter the circumstances. CZARNIKOW quotes a press report from Russia which suggests, indeed, that the Soviet plans for their beet sugar industry have fallen considerably short of forecasts. Assuming all the beet still to be sliced can be utilized, a total production of 1,635,000 tons is envisaged, instead of the

round two million tons that was confidently forecasted. But the outlying roots have been damaged by frost, so that a bare 1,600,000 tons seems the most achievable. A 15 per cent. extension for 1931-32 is talked of in Russia, but even if this increase is aimed at, actual fulfilment is too uncertain a question at the moment to have a serious effect on the plans of the rest of the sugar world.

F. O. LICHT in his latest monthly sums up the reports received from the various European countries with regard to their acceptance of the Chadbourne agreement. He shows that with the exception of Poland, no definite decision in the negotiations between the sugar industry and the beet cultivators has been arrived at in any country. Though there is no doubt that the respective resolutions will be carried ere long in all countries, it must be regretted that on account of this late decision a general uncertainty exists in all agricultural circles as to what area will be sown with beets this year. It is quite settled that a great reduction of the area of cultivation must be counted on, but at present it is quite impossible to state to what extent this limitation of area will actually reach. And apart from decreased sowings, there is the weather factor this summer to be taken into consideration. The yield of sugar per hectare in Europe during 1930-31 was much above the average of the past few years, so much so that an average yield only this year might well mean a million tons less sugar.

Java.

The principal Java producers with their headquarters in Holland, once they decided to accept the Chadbourne scheme, went about their preparations with commendable promptness. In Amsterdam they have formed a new "Association of Managers of Java Plantations," called the "Visoco," to organize the new arrangements for carrying out the terms of the pact, and to conclude the necessary agreements with other sugar producing countries. About 75 per cent. of the Java sugar growers, according to LICHT, are said to have joined already, and there are 14 per cent., representing firms domiciled in Java proper, who may be expected more or less to come in. That would leave a minority of some 12 per cent., consisting chiefly of the Nederlandsche Landbouw Mij interests. Other figures cabled from Java suggest that 78·2 per cent. are definitely for the scheme, 15·7 per cent. have refused co-operation, and 5·1 per cent. have not yet taken a decision. Whatever the precise figures, it is clear that the opposition represents only a small minority, and as the Java local Government have now introduced a Bill under which sugar can only be exported under licence and within the terms of the restriction scheme, the necessary machinery for giving effect in Java to the provisions of that scheme is well assured, and the amounts agreed to at Amsterdam as being the permissible export quotas will be enforced by the law. The Java Government concede that the new plan might have the effect of increasing the costs of production ; nevertheless they deem that it offers the only reasonable chance of an improvement in the situation, since a further fall in prices would have most serious economic consequences on the country and the population. And Dr. C. J. K. VAN AALST, speaking as an industrialist, has expressed publicly the view that if the Chadbourne plan was not put into practice it would be not only a disaster to the sugar industry, but a national calamity for the Dutch. It is clear, then, that the vast majority of the Dutch interests, both official and industrial, are in favour of restriction in sugar production and will give the new arrangements a fair trial.

The Position of Cuba.

The position in which Cuba finds herself these days is not a happy one; with every month of continued low prices for sugar, discontent is given full scope for play and sporadic outbreaks of armed insurrection figure at intervals in the news from that island. The Cuban Government have so far been able to suppress these disorders, but it remains to be seen whether the threatened revolution proves to be one of sugar prices when the Chadbourne scheme has had its effect or one of discontented people unable or unwilling to wait longer for the promised improvement. Our able Cuban correspondent in his article on another page seems for once steeped in the prevailing pessimism of his surroundings, and deems the Chadbourne plan, so far as Cuba is concerned, to be suicidal. He quotes a characteristic Cobdenite speech of MACAULAY, which expresses a view that, in an ideal world, has much to be said for it. But even in England this view has from force of circumstances had to be abandoned by all but a small section of Liberal economists. For good or evil the State everywhere has had to step in with a certain degree of control of industry, and we question whether Cuba if she carried out the Macaulay policy would not find that she had stepped from the frying pan into the fire.

Certainly Cuba cannot gain anything by unrestricted production of sugar; unless indeed her workers are content to toil indefinitely for a starvation wage. Her crop as now restricted will probably be the maximum output that is economically advisable in the future. She exports all but 150,000 tons of her crop, and those who have hitherto bought from her are not under obligation to buy the same amount sine die. The United Kingdom, for instance, will tend to prefer Empire grown sugar when available. So the Machado policy of introducing more varied industrial pursuits into Cuba is probably the wisest course, and once the Chadbourne plan gets to work and raises the price of sugar, the existing sugar industry will probably accept the position and endeavour to make the best of the improved prices. Undoubtedly it is a major grievance amongst the Cubans that the American mills in that island will be unduly favoured by the quota scheme. In the past, as was sketched by Mr. ROWE in our November issue,[1] the policy of the Cuban Government has been to champion the cause of the small and less efficient Cuban-owned mills against the large and efficient American-owned ones. But latterly circumstances have proved too strong for the Cuban owners, and it is to be feared that in the process of rationalization which is bound to be an accompaniment of restriction, these will be weeded out faster than will their American rivals. Already, however, the Americans are planning to eliminate some of their own mills and grind a larger output at their remaining establishments.

Since we gave last month the table of Exportation Allowances under the Chadbourne Scheme, the figures for Cuba have been altered, owing to revised estimates of stocks on January 1st and at ports in U.S.A. The adjustment made under Presidential decree has fixed the 1931 production at 3,122,000 tons (instead of 3,305,000); Cuban stocks on January 1st having amounted to only 1,300,000 tons, the annual segregation is fixed at 260,000 tons, while the export allowance to the U.S.A. has been lowered from 2,800,000 to 2,577,000 tons, due to deficient consumption in that country. Exports in 1931 will then be restricted to 3,232,000 tons, in 1932 to 3,382,000 tons, and in the final three years of restriction to 3,432,000 tons each. More detailed figures of 1931 can be found on page 104.

[1] *I.S.J.*, 1930, 564.

Notes and Comments.

United Kingdom Sugar Consumption, 1930.

Last month we gave the details of imported sugar consumption within the United Kingdom for the calendar year 1930. The details of home grown sugar are now available and show that we delivered for consumption in this country a total of 357,528 tons (equal to about 378,000 tons raw value), as compared with 234,732 tons in 1929 and 186,175 tons in 1928. According to Messrs. CZARNIKOW, this makes the total consumption of both Imported and Home grown sugars, expressed in raw value, for the year 1930 to be 2,070,384 tons, as compared with 2,023,932 tons in 1929 and 2,013,398 tons in 1928.

This steady increase in consumption over the last few years, in the face of increasing industrial depression and unemployment in Great Britain, must be ascribed to the comparative cheapness of the article. On the basis of the present officially estimated population of 45¾ millions the 1930 total works out at 101·03 lbs. raw value per head, as compared with 99·7 lbs. in 1929. Whether this steady increase annually will be maintained in the face of a possible rise in the price of sugar to a more economic level remains to be seen, but till the industrial outlook in the United Kingdom improves considerably, the family budgets of the wage earners will hardly stand any increase in costs. Indeed but for the very extensive application of unemployment insurance, popularly called the "dole," it may be taken for granted that the current *per capita* consumption would not have maintained its recent high level.

The English Beet Industry: A Government Offer.

Just as we went to press with our last issue the Government after a careful consideration of the position of the sugar beet industry at home decided to make it an offer of assistance which took the form of a special advance to the industry for one year only, which advance is to be deducted, in the event of sugar prices rising substantially, from the normal subsidy which will be due. The amount of this special advance is to be limited to 1s. 3d. per cwt. of sugar payable on 15,000 tons of sugar (exceeding 98° pol.) manufactured per factory in the coming campaign and is payable on the condition that a firm price is offered to the farmers ; and if the price of raw sugar (of 96° pol.) rises above 6s. 6d. per cwt., c.i.f. U.K., the amount of the special advance promised shall be abated by the amount of the rise in sugar prices.

Following on this Government offer, eleven of the factories (five of the Anglo-Scottish Group, three of the Bury group, the two Lincolnshire group factories, and Wissington of the British Sugar Manufacturers) made an offer of 38s. per ton for 15½ per cent. sugar content, 40s. 6d. for 16½, and 42s. for 17½ per cent. This is an increase of 5s. 6d. per cwt. over the previous offer and is only 2s. per cwt. less than the minimum for which the farmers' Unions had previously held out. The farmers decided to accept the offer, so in respect to these factories it may be assumed there will be no material decrease in production this year. As regards the Anglo-Dutch group, however, they stuck virtually to their original proposal to leave the farmers to take the profits of the campaign at the factory. This at present prices is asserted to be no more than 33s. per ton of 15½ per cent. beet. The farmers have persisted in their refusal to take over the factory risks, preferring to be paid a firm price for their roots. If this is not forthcoming it seems very probable that the supply of English grown roots for the Anglo-Dutch group will suffer a heavy decline. There are indications, however, that if this happens, these factories will try to supply their needs by importing continental-grown roots, which, it is said, can be imported at a price much below the figure demanded

by the home farmers. Certainly it is difficult, otherwise, to account for the refusal of these well managed factories to accept the Government offer and make the farmers a firm price, as the majority of the factories have done. A last hour attempt is being made by the farmers to get the Government to intervene in the matter, so the final word may not yet have been spoken. But for the moment a 30 per cent. smaller acreage in the United Kingdom is indicated.

The Liverpool Sugar Exchange.

According to the *Liverpool Daily Post*, the new Sugar Exchange of that city has had a successful first year, and those responsible for its establishment and operation have abundant cause for gratification. It was started during a time of unparalleled commercial depression and with sugar at a low ebb, yet the Exchange experienced a gradually increasing turnover during its first 12 months of operation.

During the year transactions have aggregated just over 490,000 tons. The contracts recently have averaged 16,000 tons per week, which nearly reaches the melting capacity of Liverpool's four refineries. In the year 651,212 tons of raw sugar came into the port, and during the period April-December Liverpool refineries melted 545,040 tons, which corresponds to an annual melt of over 726,000 tons.

The contract of the Exchanges provides for the delivery of raw sugar ex public bonded warehouse. Such a form of contract is demanded by one of the first principles of futures markets, and in this and in open trading by public outcry across the "Ring," the Liverpool and New York Exchanges stand alone in the sugar trade.

The Exchange has the advantage that its contract is for non-preferential raw sugar, and is therefore entirely independent of fluctuations arising out of decisions by Parliament as to the advisability, or otherwise, of subsidizing Colonial trade. The results achieved are looked upon as exceedingly satisfactory, and the steady progress made augurs well for its continued success.

Argentine Sugar Production.

According to the Bank of London and South America , the total production of sugar in Tucuman during the season just completed reached 277,000 tons, an increase of 40,000 tons as compared with the output for the year 1929 ; the amount of cane crushed was 3,448,000 tons, of which slightly over 43 per cent. was purchased by the mills. The other provinces produced 105,500 tons, which gives a total for the whole of Argentina of 382,500 tons, as compared with 340,000 tons in 1929.

Delegations representing sugar manufacturers, cane planters, and rice growers have lately been conferring with the national authorities in Buenos Ayres with a view to securing more adequate protection for the sugar and rice industries. As a result, the Government have appointed a committee to study all the data submitted, and favourable resolutions are expected shortly.

Jamaican Affairs.

A scheme for the erection of a Vazcane fibre board factory on the Serge Island estate, Jamaica, is so well advanced that a company called the Jamaica Vazcane Co., has been formed to finance the operation. At least £70,000 is needed for the venture and it would appear that the Overseas Trade Development Board has agreed to advance £20,000, free of interest, for a certain number of years. The remaining £50,000 will be guaranteed by the local Government under the debenture system, and be subscribed for in the island. Besides

the cane board factory at Serge Island, a sugar refinery at Westmoreland is part of the scheme, the product of which will go in part towards the local consumption of refined and in part to supply the needs of a new fruit and vegetable canning industry, on which some Canadian capitalists are embarking very shortly. The bulk of the fibre board is destined for England. This makes the second refinery to be erected in the island, as the United Fruit Co. are also erecting a plant at Vere.

Jamaica possesses a Sugar Manufacturers' Board which assumes the task of handling the sugar sold in the local market in the interests of the whole industry. By means of this pool competition amongst the local manufacturers is avoided, while the public, on the other hand, are amply protected by the fact that the Government is able to fix sugar prices at a reasonable level and to insist upon a decent standard of quality. The cost of operating the Pool is said to be no more than 5 per cent. of the total sales, while the profit which once went to the middleman now goes chiefly into the pockets of the manufacturers.

The Situation in Cuba.

By EARL L. SYMES.

The 1931 crop began on January 15th and in the past four weeks about 120 mills have begun grinding, 25 less than at the same time last year. It is remarkable that so many have started at all considering the many difficulties that exist. The price of sugar is still much below the cost of production and in spite of international proposals and the segregation and restrictive measures that have already been legalized and placed in effect in Cuba, there is not much prospect of a large increase in price. On his arrival in New York from the European Conferences late in January, Mr. CHADBOURNE stated to the press that he believed the price of raw sugar would reach 2½ cents.; some observers in Cuba are inclined to think that he meant duty paid instead of c. & f.:

The price in Cuban warehouse indicates about what the planter and mill owner receive for their sugar. The monthly averages are as follows :—

	Jan.	Feb.	Mar.	April	May	June
1931	1·15	—	—	—	—	—
1930	1·64	1·53	1·53	1·42	1·19	1·15
1929	1·78	1·68	1·67	1·61	1·54	1·49

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1931	—	—	—	—	—	—	—
1930	1·05	0·99	0·93	1·08	1·18	1·08	1·23
1929	1·82	1·80	1·93	1·97	1·70	1·71	1·72

The price in September 1930 declined to the lowest point ever recorded, being exactly one cent. less than in the same month of 1929. Considering the increase estimated in the 1931 world crop based on WILLETT & GRAY'S January figure correcting for the lower crop decreed in Cuba at the end of January, there is little prospect for an average world price higher than 1929. The course of prices in the futures market seems to indicate that agreements among producers will have little effect on prices as long as the surplus stocks are in existence. While the amount of segregated sugar to be marketed in each year is apparently settled, there is nothing to prevent an increase at any time.

On January 31st the decree limiting the Cuban 1931 crop and all exports of old and new crop sugars was issued. The total amount of sugar that

Cuba is going to permit her customers to buy in 1931 is 3,605,000 long Spanish tons. The distribution of export and domestic sugars is as follows :—

		Long Spanish Tons.
Stocks of sugar in U.S. Ports, January 1st, 1931		410,000
Stock estimated as normal by Cuba		300,000
Excess stock included in U.S. 1931 quota		110,000
Sugar shipments afloat to U.S. estimated		60,000
Sales contracts accepted as bona fide		53,000
Total already consigned to U.S.		223,000
Balance from 1931 crop for U.S.		2,577,000
Total allotment to U.S. from Cuba, 1931		2,800,000
Amount to be shipped to other markets 1931 crop		395,000
Estimated for consumption in Cuba		150,000
Net allotment for U.S.		2,577,000
Total 1931 crop permitted in Cuba		3,122,000
Decrease from 1930 crop is 33·17 per cent.		1,549,000
Total 1930 crop		4,671,000
The Allotments are then :—		
For Consumption in Cuba		150,000
For U.S. markets		2,800,000
For other markets from 1931 crop	395,000	
$\frac{1}{5}$ of 1,300,000 segregated	260,000	
		655,000
Total distribution planned		3,605,000
Ten year average distribution		4,125,000
Decrease in 1931		520,000

The average export to the United States has been 3,150,000 tons during the past ten years and the total to other markets averages 840,000 tons, home consumption taking the balance. The exports to the United Kingdom have averaged 560,000 tons. By following this method the markets are being given away, surrendered to Cuba's competitors ; the plan is suicidal.

Artificial measures such as this will not solve the problem. A quotation from the great British statesman MACAULAY is very apropos :—

> "If governments will leave capital to find its most lucrative course, commodities their fair price, industry and intelligence their natural reward, idleness and folly their natural punishment, maintain peace by defending property, diminish the price of law and observe strict economy in every department of the State, the environment will be such that the people will assuredly do the rest."

Idleness and folly are paying the penalty in Cuba and a five-year truce will not diminish the final payment. Industry and intelligence must be employed to recover additional products now known to exist in the cane fibre and molasses, and with these the deficiency in price for the sugar may be overcome. Every ton of cane brought into the factory carries 270 pounds of raw sugar worth \$3.50, besides 100 lbs. of alpha cellulose worth \$7.00. To burn this is folly, its neglect is idleness.

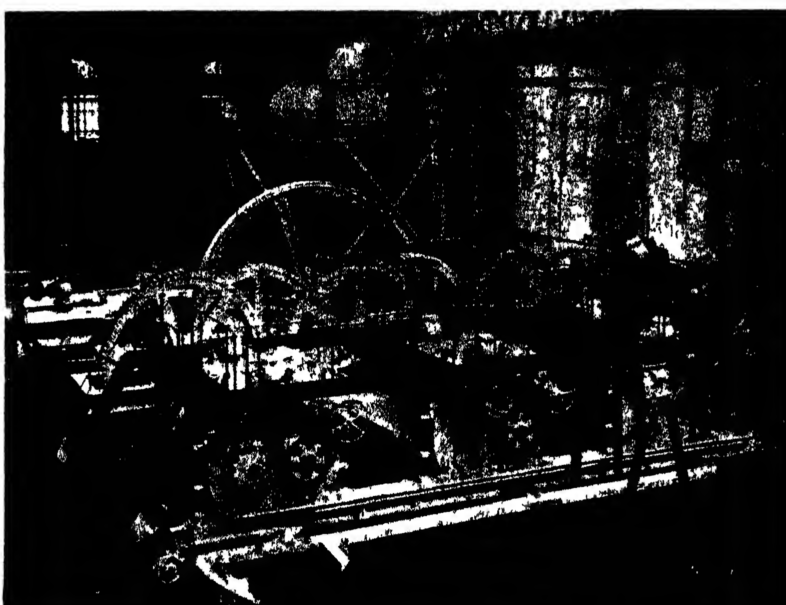
When governmental interference was lifted in April 1930, the planters were given to understand that no further regulations would be attempted.

ESTD. SMITH 1837.

DESIGNERS AND MANUFACTURERS
OF

CANE SUGAR MACHINERY

OF EVERY DESCRIPTION



11-ROLLER SUGAR CANE CRUSHING PLANT.
PHOTOGRAPHED IN ONE OF OUR ERECTING SHOPS.

A. & W. SMITH & Co. LTD.

Eglinton Engine Works, GLASGOW

TELEGRAPHIC ADDRESS • "ENGINE," GLASGOW.
LONDON OFFICE — 8, GROSVENOR GARDENS, S.W.1.

Those who were able made extensive plantings, for some unexplainable reason, and now find themselves under the most drastic restrictive control that any people have had to accept. When the government forces the farmer to leave one-third of his standing crop uncut without any compensation for the losses thus incurred, a serious condition is apt to develop.

The small mill owners have begun to realize that the Five Year Plan in Cuba is going to eliminate many of them; they attempted to put through a sliding scale for restriction which would allow all producers with mill capacity under 100,000 bags to make their full crop, and apply the restriction to all amounts exceeding that, the first 100,000 bags to be untouched at every mill, large or small. This was voted down at the meetings in early February, and as a result no voluntary agreement on quotas could be reached and their determination is now resting with the C.E.N.A., the new export corporation, and its findings will need the confirmation of the President of the Republic.

The spokesman for the small producers stated at the final session that he and his partisans would refrain from voting for any method of calculating quotas since it would be like signing their own death warrant and they would prefer to have someone else assume that responsibility. About ten dollars is paid out in labour on each ton of sugar and the severe cut in production in 1931 will eliminate $15,000,000.00 from the total that circulated among the workers last year. This is another serious aspect to the situation; really the outlook for 1931 in Cuba is very dark in spite of the light which the international proposals are supposed to bring to the sugar world. With the deep cut in the Cuban crop partially offset by the estimated increase by other sugar producers, it is possible that the present sacrifices will be as useless as those of the previous restriction years when increases in other countries more than made up for the reductions in Cuba.

The world's record for cane ground was broken by Central Jaronu on two successive days. The total ground on January 27th was 1,053,717 arrobas, and this exceeded on the 28th by milling 1,077,319 arrobas or 12,196 long tons of cane. Tandem A ground 3629 tons, B 3590 and C 4977. Three to seven minutes was lost by each tandem during the 24 hours. The polarization in bagasse was 2·75, 2·86 and 3·05 for the three tandems and the polarization extraction 94·60.

Several cane harvesters modelled on the Falkiner have been brought in from the United States and are at work in Camaguey. It is reported that preliminary trials are satisfactory. If successful this machine will help to eliminate the Haitian and other West Indian labour which forms a serious problem in the long dead seasons when work is scarce.

Some interesting data on the 1930 crop have now become available. The Cuban Department of Agriculture has issued its annual resumen of data from the different mills. For the first time a goodly number of the plantations have reported the yield of cane per unit area of fields harvested. From this information it has been possible to calculate the total area from which cane was cut for each Province. Yield reports were received from 72 per cent. of the total area cut, so that it seems safe to assume that the remaining 28 per cent. would not vary greatly from this average. The table is given on the next page.

Dr. FRANCIS MAXWELL converted all field yields to short tons per acre,[1] and since this is the term used in most countries where areas are given in acres it seemed preferable to the long ton per acre occasionally seen. From the table it will be noticed that the acre yields do not vary much in the

1 In "Economic Aspects of Cane Sugar Production."

1930 Production of Cane and Sugar in Cuba.

Province	No. Mills	Acres Harvested Estimated	Acres Harvested Total Reported	Per Cent.	Long Tons Cane	Long Tons Raw Sugar	Yield per Cent. Cane.	Short Tons per Acre. Cane	Short Tons per Acre. Sugar	Avg. Long Tons Sugar produced per Mill.
Pinar del Rio	10	121,915	112,142	92·0	1,635,945	187,139	11·42	15·11	1·72	18,714
Havana	12	233,133	102,612	44·0	3,081,104	357,859	11·52	14·89	1·72	29,821
Matanzas	23	339,005	232,936	68·7	4,670,302	568,850	12·12	15·48	1·88	24·732
Santa Clara	46	576,284	461,405	80·1	7,387,884	879,812	11·94	14·36	1·71	19·127
Camaguey	29	795,920	507,529	63·7	11,279,202	1,392,858	12·42	15·81	1·96	48,029
Oriente	37	836,564	713,511	75·3	10,737,180	1,351,946	12·61	14·34	1·81	36·539
Total	157	2,902,821	2,130,135	72·7	38,791,617	4,738,464	12·25	14·89	1·82	30,181
Total, metric ha.	—	1,174,772	862,066	M.T.—	39,414,222	4,814,516	MT/HA	33·37	4·09	—

Proportion of Sugar Produced by Different Farming Systems.

Long Tons Avoirdupois of Raw Sugar 96 Test 1930 Crop.

Province.	Administration.	Per Cent.	Mill Colonos	Per Cent.	Independent Colonos.	Per Cent.	Total.	Per Cent. Total.
Pinar del Rio	42,699	22·82	85,091	45·47	59,349	31·71	187,139	3·95
Havana	40,195	11·23	250,613	70·03	67,051	18·74	357,859	7·55
Matanzas	34,896	6·13	324,673	57·08	209,281	36·79	568,850	12·00
Santa Clara	92,020	10·46	640,734	72·83	147,058	16·71	879,812	18·57
Camaguey	232,381	16·68	1,035,576	74·35	124,901	8·97	1,392,858	29·39
Oriente	430,932	31·88	747,145	55·26	173,869	12·86	1,351,946	28·54
Total	873,123	18·42	3,083,832	65·08	781,509	16·50	4,738,464	100·00
Four Western Provinces	209,810	10·52	1,301,111	65·26	482,739	24·22	1,993,660	42·07
Two Eastern Provinces	663,313	24·18	1,782,721	64·94	298,770	10·88	2,744,804	57·93

different sections of Cuba and that the great tonnages formerly associated with the newer lands of the two Eastern Provinces have now come down to a level near those of the four Western Provinces :—

	Yield Short Tons per Acre. Cane.	Sugar 96°	Rainfall Inches 1928	1929	1930	Normal
Pinar del Rio, Havana, Matanzas and Santa Clara	14·80	1·76	45·40	51·08	57·19	57·64
Camaguey and Oriente	14·95	1·87	46·02	45·04	44·46	48·89

The cane farmer's or colono's association has recently published data on the proportion of cane produced by the three different farming systems in use in Cuba. The amount of sugar derived from the cane is shown (see page 106).

Both divisions seem to use the same number of colonos controlled by the mill, but the Eastern Provinces raise about a quarter of their cane under administration direct. From this table it is apparent that the mill owners control closely 83·5 per cent. of their cane supply and that the independent colono occupies only a small position in the general scheme.

Notes on the Economical Production of Sugar.[1]

By Dr. WILLIAM E. CROSS.

In some factories an attempt has been made to reduce the cost of sugar manufacture by increasing the amount of cane milled per day, and thus obtaining a reduction in the relation between the total amount of sugar produced and the general overhead expenses of the factory. It is very doubtful, however. if this method will give the desired results, as its advantages are outweighed by the lower extraction and "retention," which affect the whole of the cane ground, and by the increase in general expenses produced by the crowding of the factory with cane. Although we do not say there are not special cases, in general we believe that the working of the factory at excessive capacity is only justified when there is a large quantity of cheap cane available, which has to be ground within a limited time, and when sugar prices are also low. Under normal conditions the amount of cane milled per day should be limited to that quantity which can be handled with a maximum of extraction and sugar yield. We will now proceed to discuss some other factors which are of importance in the economical production of sugar.

Selection of cane lands.- In every sugar growing district, there are lands which produce excellent tonnages of cane and sugar per acre, and others which are inferior in this respect, and produce only low tonnages. These latter should not be planted in cane until they have been "improved" by green manuring and other means that may be necessary. Lands which are already planted in cane which give low yields should be subjected to a severe control of the tonnages produced and the costs of cultivation, etc., so that they may be ploughed up just as soon as the cane they produce becomes too costly. We know many fields of cane which are already in this condition, which are cultivated year after year at considerable loss. And in all the fields, when the cane has ratooned for a number of years, a strict watch should be kept on the yields produced, so as not to go on cultivating them longer than is profitable.

Planting.—As we have said, cane should only be planted in lands which will produce good yields. These should be very thoroughly prepared before the planting is made. If the lands are very infested with weeds, like Bermuda

[1] Translated by the author from the *Revista Industrial y Agricola de Tucuman*, Vol. XX, pp. 105-114, 1930. This paper was originally prepared for the instruction of the Argentine planters generally; we reproduce it in our pages as we think it will be found of use to those of our readers not closely associated with the technical side of the sugar industry. It contains a number of valuable hints on the best practice in vogue in the sugar industry.—ED., *I.S.J.*

grass or Johnson grass, these should be thoroughly eliminated before the cane is planted, as it is obviously much easier to fight such weeds in an unplanted field than in the rows and middles of planted cane.

The amount spent by the different planters in preparing the land for planting varies greatly, especially because of differences in the cost of ploughing and harrowing per acre, and we would recommend every planter to investigate what he is paying for this work, in order to reduce the cost as low as possible without of course sacrificing the quality of the work done.

It is in these operations of preparing the land for planting that the tractor finds its best application in the sugar industry, especially in the case of factories which can employ as fuel for the tractors, alcohol, free of tax, of their own manufacture.

In some parts, the furrows are still opened with spades, which of course is an out-of-date and costly procedure. For, indeed, the furrows can not only be opened, but also given the necessary depth, by means of suitable ploughs, and this at a very low cost.

The covering of the cane can be carried out with ploughs, or better still by a cultivator specially designed for this purpose, like the Planet Jr. attachment : these machines properly used do the work better than the peon with the spade, and very much cheaper.

For the economical production of sugar, it is of the greatest importance that the cane planted should be scrupulously selected, as the difference in production between selected and non-selected cane is very great. To select the cane, in the first place a thorough inspection should be made of all the fields of cane available, picking out those where the cane is healthiest and freest from insect pests, and at the same time, in the case of the POJ 36 and 213 usually planted in Tucuman, of the deepest purple colour. These selected fields will provide us with the cane for planting, although this, once cut, must be submitted to a second selection, stalk by stalk (carried out by the more intelligent field hands) in which the healthiest stalks only will be chosen, and those freest from borer, mealy bug, etc.

It is very necessary to ensure that the planted cane will give well filled rows, without gaps which will have to be replanted later : this is done by planting the cane before the time when frosts are expected, and employing a sufficiency of running stalks to give the necessary number of sprouts per row. At least two running stalks are generally necessary for this purpose, although if in spite of the selection the cane is not too good, two and a half or even three running stalks may have to be employed.

We have shown that in Tucuman the same quantity of cane and sugar per acre is obtained, whatever be the distance between the rows from one to two metres. Therefore, seeing that in this Province all the cultivating work is paid for at the rate of so much per row, the cost of cultivating is lowest when we have a minimum number of rows per acre, which is obtained, within the limits mentioned, planting at two metres.

It is very desirable to plan out the fields of cane in such a way that the rows of one field are in a continuous line with those of others, which permits that the cultivating implements can go in a straight line for several hundred yards before turning round, instead of their having to turn at the end of each field. This is specially important when the cultivation is carried out by a train of implements drawn by a tractor. The planning out of the fields should also be done in such a way that the cane can afterwards be irrigated with the greatest facility and economy. And in the third place, the fields should be of a convenient size to allow them to be burned off before harvesting without

burning more in one day than the amount that can be taken by the mill. These fields should be divided one from the other by a sufficient space to ensure that, with reasonable precautions, the fire will not extend beyond the limits of the field being burned.

Cultivation.—In the economical production of sugar, all the cultivation of the cane should be carried out by means of suitable mechanical cultivators, with the exception of an occasional weeding of the rows themselves, and the taking earth off the plant cane, which must be done by spade or hoe. For throwing earth to the cane the disc cultivator is employed, straddling the row, and for the cultivation of the middles the small one-mule cultivator like the Planet Jr., or the reversible disc harrow. The operation locally called "desaporque," or the laying bare of the stubbles after burning off the trash, by means of grubbing hoes, should be replaced by the cultivation of the rows by the stubble shaver, followed by the stubble digger. The off-barring is done on the two sides of the row at once, by means of the implement with two large discs which is sold for this purpose by AVERY and others. If tractors are employed in the cultivation, one tractor can draw in a train, straddling the row, the off-barring implement, the stubble shaver and the stubble digger, thus reducing the cost to a minimum.

The cultivation of the cane should be begun as soon as possible after the danger of freezes is past, in order to allow the cane a maximum of time to develop before the next winter. It is especially important to carry out as early as possible the removal of earth from the plant cane, with the object of only leaving a few centimetres and thus accelerating the germination, and obtaining well filled rows of cane of uniform development.

Manures.- In some special circumstances, nitrogenous fertilizers can be advantageously employed to increase the production of the POJ 36 cane, in specially privileged lands, as for example those near the factory, or those in frost-free zones, or where irrigation water is specially abundant.

Irrigation.—This should be carried out scientifically, the water being applied with the frequency necessary to supplement the rains, in such a way that the cane does not suffer at any time for lack of sufficient moisture. At a suitable interval after each irrigation the middles should be cultivated in order to conserve the moisture and avoid the accumulation of alkali in the soil.

Harvest.- The order in which the different fields of cane are harvested will depend on the maturity attained by the cane, determined by periodical analyses of samples from the different fields. In general, the cane cut in the first few weeks of the Tucuman crop will be mainly POJ 213, which ripens earlier than the POJ 36. The plant cane should not be cut until it is well ripened, which is not to be expected until the grinding season is well advanced.

This rational system of harvesting the cane should also be applied to the fields of independent growers, and indeed, in the case of those who produce cane on a large scale, the factory chemists should co-operate with the grower, analysing for him the samples of cane from the different fields, exactly as they do with the factory's own cane.

A big economy is obtained in the harvesting of cane by burning it off before cutting. This method has been tried repeatedly in Tucuman with complete success in all cases where it was properly carried out, and as is known it is the usual custom in certain other sugar countries. In working with this procedure, there should be burned off in the afternoon that amount only of cane which can be cut and taken to the mill during the course of the next day. The harvesting of the burned-off cane consists simply of cutting and topping the stalks, for the trash has already been eliminated by the fire.

The cost of harvesting in this way is only one half of that of the usual method.

In the harvest special attention should be paid to the proper topping of the cane, in order to ensure that no unripe joints are ever taken to the mill.

When the cane has been subjected to freezes of importance, very special attention must be paid to the order in which the fields are harvested, and indeed to the harvesting in general. The amount of damage produced by the freeze must be determined in each field, and these must be cut in such order that a minimum of cane is lost, while at the same time no cane is taken to the mill which can not be converted into sugar with profit. The topping of the cane should be as drastic as necessary in order to discard as completely as possible the part of the cane which has suffered most damage.

Exactly what is the minimum of sucrose content and purity with which frozen cane can be accepted for the mill depends on many factors, among which figure as specially important the cost of the cane, the selling price of sugar, the "efficiency" of the factory, and the manufacturing costs. Only on the basis of thorough calculations for each factory, coupled with good judgment, can a frozen cane situation be handled in such a way as to obtain the maximum benefit possible for the factory, without incurring the very considerable losses which result from milling cane which is too much damaged. The mistake most commonly made is to grind at a loss cane which should be left in the fields.

Transportation.—In order that the transportation of the cut cane will cost as little as possible, it is necessary in the first place to reduce to a minimum the distance that the cane must be carried : by intensifying the production of cane in the lands relatively near to the factory, and exchanging with other factories as far as possible, both factory cane and bought cane, in such a way that all cane is ground in the ingenio nearest to the fields in which it is produced. In this way, also, the delay produced in getting the cane to the factory will be reduced to a minimum, and thus the cane will suffer the least possible "inversion." In general, transportation by Decauville or light railway is more economical than road transport.

For the economical production of sugar it is very necessary to do everything possible to reduce the losses which the cane may suffer between cutting and milling, for as is well known the POJ 36 and 213 canes mainly cultivated in Tucuman begin to deteriorate and "invert" very rapidly after being cut. The best way of preventing these losses is to ensure that all cane is ground within twenty-four hours of cutting. The loading and transportation of the cane (both factory and bought cane) should take place within at most a very few hours of its being cut ; the time employed in transportation should be reduced to an absolute minimum (keeping as we have said the distance of the cane fields from the factory as short as possible) ; and once the cane is received in the factory yard it should be ground without delay. As justification of the great importance we give to this matter, we would state that in the sugar industry of the world very large sums are lost annually by this inversion of the cut cane. For it must be remembered that this loss is not measured alone by the amount of sugar lost by the inversion which takes place : extremely important also is the lower availability of the sugar which remains uninverted, owing to the simultaneous changes which take place among the non-sugars of the cane, with the formation of a greater proportion of noxious and melassigenic substances.

(*To be continued.*)

Mill Control Formulae.

By NOËL DEERR.

At the Java Meeting of the International Association of Sugar Cane Technologists, in 1929, there were presented : (1) A summary of the various methods of and terms employed in milling control by representative bodies from all parts of the world. This detailed and complete summary was prepared by Dr. ZERBAN ; (2) A summary and criticism of these methods very ably presented by Mr. C. SIJLMANS ; and (3) Proposals breaking new ground and due to the present writer.[1]

I was unable to be present at the Meeting and, as my proposals were quite properly subjected to criticism, opportunity is now taken to reply to the points which were raised. With much, and indeed most, of what Mr. SIJLMANS has put forward, I am in agreement ; and the basic comparison of mill operation used in Java :—

$$\frac{10{,}000 \times \text{brix per cent. bagasse}}{\text{Brix normal juice} \times \text{fibre per cent. bagasse}}$$

is accepted by me with limitations. This same quotient in the form $\frac{(1-e)(1-f)}{f}$ where e is the extraction and f the fibre in cane has also been derived and used by me. The limitations to its use as conceived by me are that it only corrects for variation in fibre, and does not allow for either the influence of variation in quantity of added water or for difference in the number of mills in the train.

As far as can be gathered from the Java publications, no attempt is made to compare the efficiency of operation of different trains, and comparison is limited to such results as are obtained by identical trains ; and, writing open to correction, there does not seem to be any allowance made for varying quantities of added water. Hence, as Mr. SIJLMANS points out, the Java expression " is plainly a criterion for the milling *result* and not a criterion for milling *efficiency*." I, however, wished to go a step further, not wishing to remain satisfied with a comparison of *results*. I, therefore, attempted to devise an expression, derived as I still think simply and logically, to combine not only results but also efficiency, including the varying factors contained in the operation of a milling train.

So much for the general principles involved ; as regards particular items of comment, these may be taken in detail. For various reasons quite correctly given by Mr. SIJLMANS, it is apparent that when the quantity of added water is increased, the admixture becomes less effective and Mr. SIJLMANS remarks : " NOËL DEERR's performance figure will create the impression of a worse result when we give more imbibition water in order to get a better extraction."

We are here looking at the matter from different view points. I agree that an erroneous impression may be so created if the argument upon which a result is examined is imperfectly appreciated. In this case, however, the actual fact and the comparison with what I have termed the " ideal performance " are not inharmonious. With increased addition of added water, the efficiency of the added water falls, and the expression I have derived expresses this fall in efficiency, which was precisely what I intended.

Neither can I accept as well taken the comment : " The criterion which NOËL DEERR uses as a basis for judging the primary extraction, namely, the fibre percentage of the primary bagasse, is incorrect, as the proportion

[1] *I.S.J.*, 1930, 471.

between juice and fibre in primary bagasse is dependent on the proportion of juice and fibre in the cane, or on fibre per cent. cane.

I accept, without question, the validity of the observations made in Java that the proportion of juice and fibre in primary bagasse is dependent on the proportion of juice and fibre in cane, and that with higher fibre in cane it is easier to obtain higher fibre in bagasse. This effect is probably due to a greater quantity of rind tissue in high fibre canes, and I fail to see how any simple expression can be devised to express, algebraically, differences in the nature of the material. The derivation of the expressions I have obtained postulated an ideal material consisting of juice and fibre and did not attempt to differentiate between rind tissue and pith. To do this, it would have been necessary to introduce arbitrary assumptions and this I have tried to avoid.

Here is, however, another point to which Mr. SIJLMANS' criticism applies. The criterion of milling results accepted in Java when put in the form $\frac{1-e}{f}(1-f)$ is of course applicable also to single crushing, and when applied to a plant of this nature it reduces to the form $\frac{1-m}{m}$, where m is the fibre in bagasse, and in which f does not appear. If then, the value of m depends on the value of f, any objection to the use of m alone as a criterion of the efficiency of milling will and must apply equally to the use of the value of $\frac{m}{1-m}$. Indeed, the influence of this criticism will follow all through the imbibition train. I cannot believe that Mr. SIJLMANS intended this application, though it is a rational sequence if his criticism is to be carried through to its logical conclusion.

There is, however, an objection to the use of a fixed value of m as a criterion of milling operation. The rational basis of comparison, as I have pointed out many years ago, would be volume of juice retained per unit weight of fibre and as the density of a juice increases, the weight of a fixed volume of juice will also increase and, under equal pressures, the value of m will increase with decrease in density of juice. In the attempts I have made to derive a rational expression for the operation of milling, I took m as constant throughout the process. To have given a progressively increasing value to m would have complicated the derivation without any corresponding gain.

As regards the comments made in the discussion by Prof. VON PRITZELWITZ VAN DER HORST, I cannot altogether agree that the assumptions made by me are arbitrary. If I had taken some figure, say 50 per cent., in place of 100 per cent. to denote the degree of admixture of added water, then "arbitrary" would be a proper criticism. But in comparing technical performances, a standard of 100 per cent. is almost universally accepted; examples of such comparisons are to be found in the expression of the results of the operation of furnace plants, of engines, of dynamos and of numerous other kindred appliances. The choice of 0·5 as a value for m is of course arbitrary. In this case, it is self-evident that m could not be put equal to unity, as if so a complete extraction would obtain with a single crushing unit. The value accepted as a standard for m represents reasonable modern practice and it has the advantage that calculations are simplified in a great degree by its use.

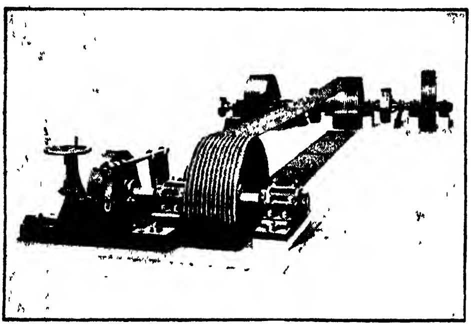
Finally, I am at variance with Mr. PECK when he says that "the control methods proposed by Mr. DEERR are far from simple." While the visualization of the problems involved demands some small degree of mental con-

Heywood & Bridge's

FRICTION CLUTCHES AND MODERN MILLGEARING

IMPROVED PATENTS

Solves Your Driving Problems



Main Drive from Large Oil Engine with Heywood & Bridge's Type "A" Friction Clutches and Reduction Gear for Slow-Speed Shaft.

The only satisfactory way of settling the drive and type of clutch to be used is in consultation with those who possess data referring to hundreds of such installations, together with data of their behaviour over periods of years. We have been in daily touch with driving problems of all kinds for over 30 years. We can offer a choice of thoroughly efficient and economical drives for practically any purpose. Put briefly, the Heywood & Bridge Clutch saves power by transmitting the maximum amount delivered by main shaft. The smooth and even drive made possible by this clutch eliminates shock and jar, thus prolonging the life of belts and gearing.

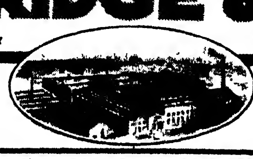
Our High-Grade Millgearing

like our clutches — is designed for long and satisfactory service. We make a speciality of Machine-Moulded Gearing for accuracy and quick running. 13 Wheel-moulding Machines. Over 8000 Wheel Blocks. An engineer representative will wait on you with suggestions, if desired.

Write for our Illustrated Catalogue. Sent Post Free.

DAVID BRIDGE & CO. LTD.

CASTLETON FOUNDRY & ENGINEERING WORKS.



CASTLETON MANCHESTER

LONDON OFFICE:- 35, QUEEN VICTORIA ST E.C.

centration, the derivation of the fundamental formulae requires no more acquaintance with algebraical processes than a knowledge of geometrical progression, such as is given in any elementary text-book.

On further study, however, of what I regard as the fundamental equation upon which a rational analysis of the operation of milling plants may be based, unforeseen difficulties, mainly concerned with elementary definitions, appear which make it hard to answer the question. I set myself to solve :— " A plant of n rollers operating with w water on cane with f fibre obtains an extraction e; another plant with n^1 rollers, w^1 water, f^1 fibre obtains an extraction e^1. Which plant has operated most efficiently ?" I hope to return to the subject at some future date.

Observations on the Sugar Industry of the Argentine Republic.

By J. T. J. CROOKS.

With the exception of the statistics from the Experiment Station at Tucuman, very little actual working information on the Sugar Industry in the Argentine Republic has been published in the English language. This is probably due to two reasons : First, as practically all the sugar produced in the Republic has to be consumed there owing to the high cost of production (due to the high wages paid to the workers and the high customs tariff against imported sugar), the figures representing the production and consumption do not affect materially the World's statistics, and thus the interest outside of the Republic is slight. Secondly, as Spanish is the only language officially used there, the translation and republication of data are probably not worth while. The writer who spent the 1930 *Cosecha* in the Argentine will endeavour to supply some information bearing on this most interesting country.

Tucuman is the principal province producing sugar in the Argentine Republic with nearly 130,000 hectares planted with sugar cane. The second province in importance is Jujuy with about 15,000 hectares, and the next Salta with 5000 hectares. Sugar cane is also grown in the provinces of Chaco, Corrientes and Santa Fe, but only in very small quantities. Tucuman has 28 ingenios (factories), Jujuy 3, and Salta 2.

Tucuman is situated in the North-West of the Republic, and through its westerly portion pass some of the highest ridges of the Andes. Spurs of these mountains also cover the North of the province and effectively separate it from the provinces of Jujuy and Salta which are situated beyond to the North. The eastern part of Tucuman, with the exception of the North, is composed of a huge flat plain. The sugar cane is principally cultivated at the foot of the mountains of the West and also on the plains of the East. It is thus well watered and is the most fertile land in the province.

Jujuy and Salta are situated to the North of Tucuman. They are both mountainous in the South, with picturesque and fertile valleys, and plains to the North. Sugar cane is cultivated in these valleys, and also on the plains.

All the sugar cane plantations are found situated between the latitudes 23° and 28° South, that of Tucuman between 26° and 28°, Jujuy 24° and Salta 23°. It must, however, be noted that all the land, upon which cane is cultivated in the Argentine Republic, is considerably above sea level. In Tucuman it is from 350 to 400 metres and in Jujuy and Salta it is even considerably more. Being at such a great distance from the sea coast, and combined with the other

conditions, the climate is subject to great differences of temperature, with extreme heat in the summer and very cold in the winter.

The rainy season commences about November and lasts till March or April (Summer) and from April to November heavy rains are not uncommon. An average of about 975 mm. of rain falls per year in Tucuman, 750 mm. in Jujuy and 575 mm. in Salta. The temperatures, maximum and minimum, are : Winter in Tucuman 18°C. and 0°C. (in 1930 —5°C.), in Jujuy and Salta 20°C. and 5°C.; summer, in Tucuman 37°C. and 20°C., in Jujuy and Salta 30°C. and 16°C.

The sugar cane in the Argentine Republic is harvested during the short dry season of winter, generally from about the 1st June till the end of October. From the commencement of the harvest, frosts are liable in Tucuman, and these cause (if the frost is severe, say below—8°C), great losses of rendement, especially towards the end of the crop when the cane that has been frost-bitten receives the scorching heat of the sun in September and onwards. It is therefore essential to get through the *cosecha* as quickly as possible. In Jujuy and Salta conditions are not so bad and less loss is experienced, with corresponding higher rendements being obtained.

Very little land for growing cane is owned by the factory proprietors and the bulk of the cane is supplied by small farmers, who have to deliver the cut and cleaned cane to either the factory or one of the factory's loading stations on the railway. It is nothing unusual for one of the large ingenios (factories) to receive cane from over 500 of these small growers, spread over many miles of country. The methods of transport are very poor and it is a problem which is engaging the whole of the industry in the Republic for a means of improvement.

In 1926 there was such a great surplus of production over consumption that the Government passed a law that no factory should produce in any future year more than 70 per cent. of the sugar produced that year. This limitation of production, although having eased the situation generally, is not nearly enough, as large stocks of sugar are remaining from previous crops at the commencement of each season. It is absolutely impossible to export the surplus of production over consumption owing to the very high costs of manufacture.

The cane is planted in *surcos* (furrows) each 100 metres long, and the amount of cane for the harvest is calculated at so many kilos per *surco*. The chief varieties of cane planted in the Republic are POJ 36, POJ 213 and POJ 2725, with only small percentages of other seedlings and local canes. The Java seedlings undoubtedly saved the situation a few years ago when the local varieties failed. On examination of the canes supplied to the factory for grinding, these Java canes were shown to be remarkably free from disease, but in many cases there was evidence of damage due to borers. In the Tucuman area the canes were only very thin and short, but this is due to the short growing period, the plants not having time to develop, consequently the yield per hectare or *surco* is only very low. Another cause of the poor yield is due to the impoverished land. No fertilizer of any kind is ever supplied to the land, and after a plant crop it is quite common for from 6 to 8 ratoon crops to be taken off before replanting. No rest is given to the land after the last ratoon crop is taken off : the land is ploughed and the new crop is put in. In general, the land upon which cane is planted in the Argentine is rich in potash content but it is very poor in phosphoric acid and calcium. The reason will therefore be understood for the poor crops in this country. Labour is very

expensive ; the minimum wage is 4 pesos 20 centavos (roughly 7s.) per day, and this may in some way account for the high number of ratoons produced and the lack of cultivation and attention that the fields of cane receive in this country.

At harvest time, cutters are engaged from other provinces who arrive in their own carts, and these are also hired by the farmer. It is no uncommon sight to see these carts arriving containing, besides whole families, the whole of their household effects. Rooms are provided in some cases and in others quarters have to be hired in the various localities. The carts used for transporting cane in the Republic are all alike and are very massive, and will hold from 2 to 3 tons each, and are drawn by from 5 to 8 mules or bullocks. They have wheels 9 ft. in diam., and are heavy and cumbersome.

Only in the cities of the Republic are there made roads. In the sugar districts there are no roads, only tracks, and these after rain has fallen for a short time are rivers of mud, in many cases over two feet thick. The same conditions exist between the farms and the factory and one day's hard rain will stop supplies of cane arriving for the mill for several days. It is impossible to make good roads, as there is no stone available in the locality and it would have to be transported hundreds of miles for that purpose. Distances are great in the Argentine and the population small. It is therefore impossible to expect the Government to make better roads. This is one of the problems referred to before.

If the planting and cultivation of the cane together with its transport to the factory are behind the times, the factories or ingenios are well built and efficient and are surprisingly large. Some of the largest are capable of grinding from 3000 to 4000 tons of cane in 24 hours.

With the exception of two, which are owned by British interests, the whole of the ingenios in Argentina are owned and controlled by Argentinos who are mostly the descendants of early pioneers from Spain. In many cases, although legally controlled by Administrators, the actual management is vested in the various members of the owning family, which state of affairs is bad in every way, as it results in divided control.

In all factories of the Argentine, white sugar is produced, some by the sulphitation process alone, whilst the majority refine with animal and vegetable charcoals. A beautiful white sugar is obtained, and this is sent to the market as Pilé and Granulated. The pilé is centrifugalled into large pans or blocks, and these when cold are crushed or rather broken by spiked rollers into small irregular pieces of from one to two inches in size.

The juice from the mills is sulphured to acidity cold, lime is added to about pH 6·5 and then passed through juice heaters at 100°C. (The juice is kept very faintly acid, to allow for the minute particles of undissolved lime, which dissolve later, and if the juice is any way alkaline the colour of the final sugars is liable to have a yellowish tint). From the heaters the juice is sent to the Dorr clarifiers, the clear or clarified juice going to the evaporator supply tank, and the sludge going through patent filters which separate the remaining liquid from the solid matter.

The juice is thickened to about 32°Baumé and is boiled to massecuite, the resulting sugar forming firsts, the spinnings from which are boiled into a second sugar ; the resulting molasses have an apparent purity of 32 per cent. and this is used for the production of alcohol and molassecuite. Both the first and second sugars are separately affined, then mixed, and go to the melting pans for the refinery. The washings from these affinations are thickened and are boiled back into the first product. The mixed first and

second affined raw sugars are melted in blowups, phosphoric acid and lime added, and brought up to boiling point. The impurities rise to the top and are carefully skimmed off, and the solution is first passed through automatic filters to remove any suspended matter, and secondly through char filters to whiten it. From these filters, which are of the Danek type the liquor goes to the pans of the refinery and is boiled to massecuite. First and second boilings are centrifugalled to pilé, third and fourth to granulated, and the fifth is mixed with first and second raws. The spinnings from the last refinery boiling are returned to the supply for the first raw sugars.

The rendement in Tucuman is low, averaging about 7·5 per cent., but is better in Jujuy and Salta where from 9 to 10 per cent. is usually obtained.

A very large quantity of alcohol, of a very high quality indeed, is produced in the distilleries which are part of the equipment of every ingenio in the Republic. The stills used are mostly of French origin. Large quantities of spirit are used throughout the country for lighting purposes, but like the production of sugar, the amount produced greatly exceeds the demand. Keen competition amongst the various factories has resulted in producing an alcohol which is superior to that generally produced in other sugar countries. The excise tax is only nominal, with a result that alcohol (rectified) is used for all manner of purposes. Large quantities of perfumes and eau-de-Cologne are manufactured in Buenos Aires and the alcohols produced at the ingenios are accepted for that purpose, which fact is some indication of the quality of the spirit.

In going over the various factories in the Argentine, it is at once noticed how little of the plant has been manufactured in Great Britain. The modern equipment is variously of German, French, Czecho-Slovakian and American manufacture. When most of the factories were first started, 20 to 30 years ago, a great deal of the plant came from Britain, but of late years this seems to have changed, which is a great pity. This is hardly as it should be and it behoves the British sugar engineering firms, to do their best to remedy this, as it is well known that there is no better plant manufacturered in the whole world. The above remarks also apply to the implements and machinery used on the farms, and to the motor-cars on the roads.

ALCOHOL MOTOR FUEL.—In the course of an article on the position of alcohol motor fuels in Europe, Dr. GEORGE KALTENBRUNNER[1] says : "The consumption of alcohol as motor fuel in the countries in which it is extensively used for this purpose (France, Germany, Czechoslovakia, Sweden and Poland) amounts to about 19,500,000 gallons and probably will reach 26,000,000 gallons in the near future. Through the general enactment of compulsory laws this quantity of course could be much further increased. Under State control, too, motor alcohol could be sold at moderate prices, by offsetting the loss from selling below the cost of production by higher prices for alcohol of other kinds, especially that consumed in beverage form."

CATERPILLAR TRACTOR METHODS.—The Caterpillar Tractor Co., the enterprising American firm that produces what is probably the most widely used track-laying type of field and road tractor, regularly issues a little magazine that goes to some 325,000 users, buyers and prospective owners of the Caterpillar tractor. It contains chiefly illustrations of the multifarious uses to which the big and little tractors can be put ; and the ingenuity displayed in making use of various designs of this machine, to shift all conceivable things from where they are not wanted to where they are, makes the firm's brochure of no small entertainment to all who are interested in mechanical aids to industry. The Caterpillar Magazine can be obtained on application to the Caterpillar Tractor Co., at Peoria, Illinois, U.S.A.

1 *Facts about Sugar*, 1931, 26, No. 2, 67.

The Sugar Losses of Beet Sugar Manufacture.[1]

By H. CLAASSEN.

That in beet sugar manufacture the proposals which have been made for lowering the determined losses have as yet attracted little attention is to be traced to three reasons.

(1) It is believed that the plant and installations serving for the object in view are so costly, and that operation becomes so complicated, as to render the outcome uncertain. (2) It is thought that lowering the losses introduces at the same time so much non-sugar substances as to result in an increased yield of molasses with only a little extra crystallized sugar. (3) It is considered not worth while striving for a higher yield at the present time. This last view is false, and need not be further discussed. It excuses bad working with high sugar losses.

(A) LOWERING LOSSES BY RETURNING WASTE-WATERS.

To-day only in a few German sugar factories are the diffusion waters (press and run-off waters) directly returned into process, that is, without fermentation; but excepting Dormagen s.f. none of them has published any results of exhaustive experiments.

In all installations serving for the return of the diffusion waters to the last vessel the following requirements must be met: (1) The diffusion waters must be so freed from pulp that the circulation of the juice in the battery is not hindered. (2) These waters must be de-pulped immediately after emptying a vessel, and pumped back without delay, remaining thus only a few minutes outside the battery. (3) All causes giving rise to the formation of froth must be removed.

For de-pulping the diffusion waters, good pulp-catchers are to be employed, of which that constructed by BABROWSKI[2] has proved worth of special notice. Prompt return is quite easily carried out. It is unnecessary separately to return the diffusion waters according to their sugar contents, after PFEIFFER's directions.[3] The cost of the installation is relatively small, being for a daily slicing capacity of 1000 to 1500 metric tons of roots as follows:—

1 centrifugal pump with motor for raising the pulp-containing water from pit to catchers	3000	Marks
1 ditto with motor for transferring the pulp-free water from the collecting tanks to the battery	1750	,,
2 spare pumps without motors	1000	,,
1 pulp-catcher after Claassen as pre-cleaner for the press-water	1250	,,
1 pulp-catcher, after Babrowski for filtering the mixed waters	5000	,,
1 clarifying tank, also piping, erection, etc.	2000	,,
Cost of the whole installation	14,000	,,

There is no increase at all in the operating expenses, and the consumption of fresh water will be decreased 60 to 70 per cent. Only repair charges are higher in consequence of the gradual wearing out of the iron parts, where there is a strong flow of the slightly acid water, which also contains some sand. But, contrasted with the extra recovery of 0·1 to 0·2 per cent. of sugar in the juice, and with an increased yield of 0·5 per cent. in the dry slices, these costs amounting to 2000 to 3000 marks annually, are of no account. In my

---

[1] Abridged translation from *Zeitsch. Ver. deut. Zukerind.*, 1930, 239 263. See also *I.S.J.*, 1930, 580, 626.

[2] *Zeitsch. Ver. deut. Zuckerind.*, 1910, 1089. [3] *Ibid.*, 1906, 272.

article of 1906 on the return of diffusion waste waters,[1] I furnished evidence that the juices do not undergo harmful changes, nor are of lower purity than in ordinary working. Their acid content neither increases, nor is invert sugar detectable.

In ordinary diffusion the following amounts of sugar and non-sugars are lost in the waste-waters on the average per 100 kg. of roots :–

(1) In dry slices production with strong pressing :—

In the press-water	0·15 kg. sugar..	0·15 kg. soluble non-sugars
In the press-water	0·12 ,, ,, ..	0·10 ,, ,, ,,
Total	0·27 ,, ,, ..	0·25 ,, ,, ,,
Remaining in the dry slices	0·18 ,, ,,	

(2) In the wet slices delivered with low pressing :—

In the press-water........	0·18 kg. sugar	0·10 kg. soluble non-sugars
In the run-off water	0·12 ,, ,,	0·10 ,, ,, ,,
Total	0·25 ,, ,,	0·20 ,, ,, ,,
In the wet slices	0·25 ,, ,,	

But when operating the return of the diffusion waters, the constituents thus lost are distributed as follows :—

(1) In the production of dry slices :—

In the dry slices	0·17 kg. sugar..	0·23 kg. soluble non-sugars
In the juice	0·10 ,, ,,	0·10 ,, ,, ,,

(2) In the production of wet slices :—

There passes over into the juice, 0·15 kg. of sugar and 0·10 kg. of non-sugars. In the wet slices remain also the content of ordinary working, a further 0·12 kg. of sugar and 0·10 kg. of soluble non-sugars. In the production of dry slices one moreover obtains :—

0·44 kg. of dry slices at 10 pfg	= 4·4 pfg. per 100 kg. beets
0·10 kg. of sugar in the massecuite at 18 pfg	= 2·3 ,, ,, ,,
	6·7 ,, ,, ,,

In the production of wet slices, where an increase in the weight does not occur, and only a slight improvement in the contents, the extra yield of after-product massecuite is equivalent to 0·15 kg. of sugar = 0·20 kg. of after-product massecuite at 18 pfg. = 3·6 pfg. per 100 kg. of roots. It is seen, therefore, that the advantages are very considerable, especially in the production of dry slices, whilst the working costs only rise to about 1 to 1·5 pfg. per 100 kg. of roots, and the interest on installation demands only some tenths of a pfennig.

Hence, summarizing, investigations have proved that by returning the diffusion waters to the diffusion process, the determinable loss of sugar can be very much diminished. By returning all the diffusion waters, the usual losses in sugar and soluble non-sugars to the extent of 0·25 per cent. of sugar, and 0·25 per cent. of soluble non-sugars, are completely avoided. Returned diffusion waters after purification with lime have a purity of 70 to 80°, corresponding therefore to that of a normal massecuite. Installations for the return of the diffusion waste waters are simple and are not costly. There are no difficulties in operation, and noxious fermentation of the waters need not occur with ordinary care and attention. It can be shown that the nett gain after the deduction of working expenses is distinctly worth while.

[1] *Ibid.*, 1906, 260.

(*B*) Lowering Losses by Mashing and Subsiding Scums.

In the filter-presses used in all sugar factories to-day, theoretically the scum can be so far sweetened off as to be almost sugar-free. In practice such an exhaustive washing offers difficulties, which can be traced to the uneven nature and density of the cakes, as well as to the formation in them of fissures. Moreover, sufficient time is usually not available, besides which the juice is diluted. Then in a number of factories it has been established that there is present sugar which is difficultly or slowly soluble, this being combined chemically or physically to the lime and other substances. This sugar, the amount of which in different factories varies very much, is not shown in the ordinary analysis, being only estimated by a special method of examination.[1]

In most factories the average sugar content of the scums, including the difficultly soluble, will not lie under 1 to 2 per cent. Often lower figures are published, but these are almost always unreliable, or are to be traced to careless sampling. Only average samples can be conclusive which are taken from the heaped scums repeatedly each shift, or from the pulp when the scums are mashed. In normal sweetened-off scums, the sugar loss is 1·12 to 0·15 per cent. of the roots, the amount of which scums using 1·8 to 2·0 per cent. of lime giving 50-55 per cent. of dry substance, is 7 to 8 per cent. of the roots.

All exhaustive experiments on sweetening-off have shown that in fully-filled filter-presses more sugar is contained than can be calculated from the sugar content of the unsweetened scums. This is explained by the cloths being fully saturated with the juice, and by more or less juice remaining behind in the chambers. Repeated experiments have shown that per sq. m. of jute cloth about 0·6 kg. of juice is retained, so that in a 36-chamber press, 75 × 75 cm. filtering area, each chamber will hold 50 kg. of juice or 7 kg. of sugar. Such a press contains 880 kg. of scums, and the following amounts of juice :—

Dry Substance Content of the Scums	60%	55%	50%
Juice in the Scums	352	396	440
,, ,, Cloths	50	50	50
,, ,, Chambers (estimated)	36	36	36
Total amount of Juice	438	482	526
Sugar equivalent (sugar content of the juice being 14 per cent.)	61·3	67·5	16·7
Sugar per 100 kg. of scums dry substance	11·6	13·9	16·7

This tabulation shows how with the increase of the dry substance of the scums the amount of sugar to be sweetened-off decreases, so that it is advantageous to collect scums in the presses having a high dry substance content. This also has the advantage that the scum cakes are of even thickness and density and are more uniformly sweetened-off, and with less water. But the duration of the operation is somewhat lengthened.

At present in the ordinary sweetening-off of scums with about 150 per cent. of water, with proper sampling, and also with the newer methods of analysis, about 1·5 to 2·0 per cent. of sugar remains behind in scums having about 50 per cent. dry substance, the sugar loss calculated on the roots therefore being 0·12 to 0·15 per cent.

In order to recover this, there are two ways : (1) the installation of additional presses in order further to sweeten-off ; and (2) the mashing up of the scums emptied from the presses with water, and the utilization of the

[1] *Zeitschrift Ver. deut. Zuckerind.*, 1929, 61 ; 1930, 69. *Deut. Zuckerind.*, 1929, 1214. See *I.S.J.*, 1929, 381, 440 ; and elsewhere.

clarified (subsided) sugar-containing water for the sweetening-off of the following presses. The first way is uncertain in result, and is not to be recommended, as the further the sweetening-off is carried the more irregularly are the scums washed, due to fissuring, and due to the impossibility of removing the difficultly-soluble sugar. Hence a greater quantity of useless water reaches the juice.

But the second method has a satisfactory result, depending on the following observations and experiences : (1) That on mashing the scums with an equal weight, or with one-and-a-half times their weight, of water the total difficultly soluble sugar goes into solution. (2) That the paste obtained is easily clarified at 85°C., so that about 50 to 60 per cent. is obtained as a clear, almost scum-free, saccharine liquid. (3) That this liquid is well suited for sweetening-off the following presses, its amount about sufficing to sweeten-off the scums to about 1 to 1·5 per cent. (4) That sweetening-off, being done through the juice-channels, and not through the washing channels, proceeds much more rapidly and regularly, floating particles of scum immediately stopping up any cracks forming. (5) That for this sweetening-off only 1¼ to 1½ times the amount of water of the weight of scums is used, the sugar loss now amounting only to 0·04 to 0·05 per cent.

The installation for this method of working, as well as its control, is simple and cheap, the following being necessary for a daily working of 1000 to 1500 metric tons of roots :

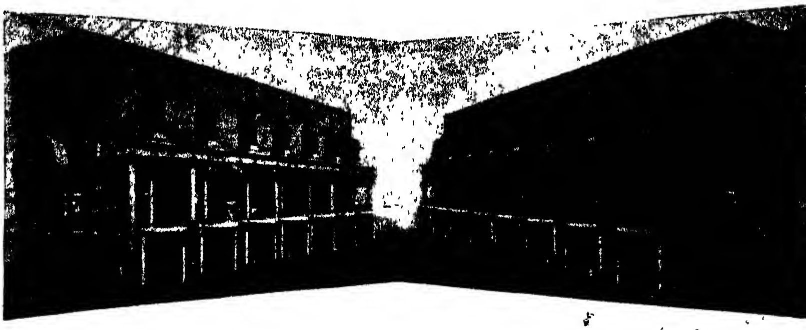
A crusher for the cakes	600	Marks
A mixer or disintegrator	1000	,,
A pulp pump with motor	900	,,
Three shallow clarifying tanks of 15 sq. m. (162 sq. ft.) surface, and 1 m. (39 in.) height, and of 15 to 20 cub. m. (530 to 706 cub. ft.) contents, with the necessary accessories and piping	3000	,,
Two supplementary clarifying tanks, in case more sugar is to be recovered	2000	,,
Storage tanks for the clarified water	500	,,
Total	8000	,,
If the scums are to be heaped, then 3 or 4 filter-presses will be required (the cost of which deducting the figures for the clarifying tanks) would be (20,000 less 5000 Marks)	15,000	,,

Dormagen s.f. has worked during the past two years with a plant as above described. In this way, this scums are sweetened-off very uniformly within 15 to 20 minutes to about 1·2 per cent. of sugar content as determined in the ordinary way, or to 2·5 per cent., according to the newer methods of analysis.

Of the amount of sugar contained in the sweetened-off scums, the following was present in the clarified waters :-

	1928-29	1929-30
Sugar in the sweetened-off scums	0·194 per cent. roots	0·147 per cent. roots
Obtained in the clarified water	0·125 ,, ,,	0·101 ,, ,,
Or, per cent. sugar in the scums	61	61

Operating costs for wages (one man per shift) and steam amount at most to 3000 marks. There remains from this a nett gain of 17,000 to 20,000 marks. This corresponds approximately to the economy of coal which can be realized by utilizing the waste gases for drying the slices, the necessary plant for which costs more than 150,000 marks, whereas in working up the scums the cost of plant is recovered in one campaign.



Of considerable significance for the utilization of the clarified water is its composition and that of the sweet-waters. Average weekly samples were taken of the clarified waters, which were evaporated to a syrup. This crystallized immediately on cooling, giving a finely crystallized massecuite. All the weekly samples were mixed, when the average of the campaign (1929-30) gave the following figures :—

Polarization	75·00	True purity	88·20
Sugar by Clerget	74·70	Apparent purity	86·40
Water	15·00	Alkalinity	neutral
Ash	3·74	Lime	0·80
Organic non-sugar	6·26	Colour, Stammer° per 100 pol.	157

Ash per 100 polarization	5·0
Organic non-sugars per 100 pol.	8·3
Lime per 100 polarization	1·1

This analysis, therefore, indicates the normal composition of a syrup of 88° purity. Sucrose by Clerget differs even less from the direct polarization than in ordinary syrups; the ratio of ash to organic non-sugars is also normal; and the colour is better. A comparative test in sweetening off, using the clarified water containing sugar, and also using pure water, showed this clearly, the sweet-waters being taken after 15 minutes' sweetening-off, after which they were carbonatated and evaporated. The results show that sweetening-off with the clarified water gave a purer last water (88·4°) than with pure water (84·9°), and they were obtained in a factory in which the scums contained very considerable amounts of difficultly-soluble sugar.

Summarizing, by mashing up the normal sweetened-off scums with water to a pulp, and its clarification by settling or filtering, most of the sugar can be recovered in the clarified water, which can be used in place of ordinary water for sweetening-off the following presses. The actual loss of sugar in sweetened-off scums seldom amounts to less than 0·12 per cent. of the roots including the difficultly-soluble sugar, and with correct sampling. But this becomes reduced to 0·04 to 0·05 per cent. in the proposed method without further diluting the juice and without any other disadvantages. The apparent purity of the clarified sugar-containing liquid amounts to 84-85° so that it lowers the purity of the thin-juice less than does the ordinary method of sweetening-off. Installations for the clarification of the scums are also very simple, entertaining small capital costs. Operating expenses are very small.

Hence, by the application of these two methods of working, viz., (1) returning the waste diffusion waters; and (2) mashing and subsiding the scums, and re-using the clarified water, one can recover 5 to 8 pfg. per 100 kg. of roots with very low plant costs; that is, much more than can be realized by any improvements in mechanical and heat-economizing schemes costing 10 to 20 times more.

Indian Import Duties Increased.—The 1931 Indian Budget which has just been prepared by the Legislature provides for an additional tariff on sugar imports. It is stated that the new figure will be 7¼ rupees per cwt., being 1¼ rupees more than the old rate.

Fletcher Factory for India.—We learn that Messrs. George Fletcher & Co., Ltd., of Derby, have just taken an order to convert a Gur refinery in India into a cane sugar factory. The plant will consist of a 14-roller mill, liming and sulphuring plant, triple effect evaporator, central condenser, and air pump. The value of the order is in the neighbourhood of £22,000.

Recent Work in Cane Agriculture.

THE EFFECT OF PLOUGHING UNDER CANE TRASH UPON THE AVAILABLE NITROGEN OF THE SOIL. **W. L. Owen and W. P. Denson,** Department of Bacteriology, Louisiana Experiment Station. *Zentralblatt für Bacteriologie, Parasitenkunde und Infektionskrankheiten.* II Abteilung. 1930, Bd. 82.

This important paper describes a serious attempt at making use of the latest methods of chemical and biological soil analysis to throw light upon the fertilizing effect of incorporating the dead leaf residues (trash) with the soil of the cane fields. Certain conclusions are drawn with regard to the use of this method of cultivation in Louisiana ; and it is therefore presumable that the local practice was envisaged by the authors. The soil and the cane leaves were obtained from the local Experiment Station, but no details are given either as to the kind of soil or the variety of cane from which the leaves were obtained. And the local range of temperature and rainfall, which is not referred to, is clearly put out of action by removing the experiments entirely from the fields to the laboratory. As all environmental factors exert a profound influence in this matter, the research thus assumes an academic or fundamental character, and this must be recognized before making practical applications of the results of the investigations, whether in temperate regions or in the tropics.

In an Introduction a brief summary is given of the chief advances, during the past thirty years, in our knowledge of the biological changes induced in the soil by the incorporation of plant residues in it. Only certain of the more important papers are referred to, and the following is a bald precis of this part of the paper, which it is thought will be of general interest. In 1899 it was noted that cellulose mixed with soil, led to a disappearance of the nitrates which it contained, and this was put down to its acting as food for de-nitrifying bacteria. But it was quickly demonstrated that these bacteria rarely affect cultivated soil, unless the conditions for plant growth are extremely unfavourable, e.g., when the soil is waterlogged ; and the conclusion was arrived at that the cellulose of the plant residues served for the rapid multiplication of micro-organisms in general. And for the next two decades the investigations of soil bacteriologists were chiefly concerned with "three phases of this subject : (1) The nature of the substances which stimulated the utilization of nitrogen by the soil organisms, (2) the species of micro-organisms chiefly involved in the process and (3) the biochemical processes involved in the successive transformations which the decomposing organic substances undergo."

In the discussion by the authors, the following ideas appear to have arisen more or less in succession : There is a competition between the growing plants and the bacteria for the nitrogen actually in the soil : the organic matter offers the bacteria abundant carbohydrate food, the decomposition of which sets free stores of energy for their rapid multiplication, and their immediate need for any available nitrogen for the building up of their cell structure leads to their appropriating it : the equilibrium of the soil nitrogen is thus disturbed, and the growing plants suffer in consequence : this state of affairs lasts for some months, during which the available soil nitrogen constantly increases, till the equilibrium is restored : but this restoration immediately takes place, when nitrogenous manure is added, with the organic matter in the first instance, or subsequently.

And, finally, it was not surprising that the idea was hit upon that, for practical purposes, it would be more efficient to separate the trash from the

soil, and compost it with some nitrogenous substance, so that the stage of equilibrium could be arrived at without depleting the small quantity of nitrogen in the soil; and when this equilibrium was reached, the compost could be applied to the soil as a valuable manure. This piece of work was carried out at Rothamsted, in the invention of the Adco process, "a method largely used on the continent and in some tropical countries." (By private munificence, a Company was formed to remove the *trading* from Rothamsted, on the understanding that any profit beyond 5½ per cent. would be handed over to Research Institutes for further work on similar lines).

It is obvious, from what precedes, that the proportion of carbon to nitrogen in the buried organic matter is of great importance in its decomposition by soil organisms. It had long been noted that, however high the ratio, carbon-nitrogen or C : N, was in the fresh material, it rapidly fell after incorporation. And this fall was only checked when it reached a permanent level at 10 : 1. Thus RUSSELL remarked in his " Micro-organisms of the Soil " that, even if the carbon-nitrogen ratio were 40 : 1 it would reach 10 : 1 before long. This curious phenomenon was first explained by WAKSMAN in 1924, who showed that this fixed ratio is exactly that obtaining in the cell structure of the micro-organisms concerned. And since that time, WAKSMAN and his co-workers have developed " a fundamental conception of the interrelation between the composition of the residue, and the rate of its decomposition, of the significance of CO_2 evolution and soil fertility, of the rate of decomposition of crop residues at different ages of growth, and the nature of humus, and its rôle in the soil. So broad and so fundamental have been his contributions to this hitherto little understood relationship of plant composition and its transformation into soil humus, that to determine the effects of the addition of any crop residue to the soil, one need only subject the material to the methods of analysis established as routine procedure in his investigations."

Because of the economic importance of the subject, the authors set themselves the task of determining the principal rôle of buried trash upon the available nitrogen of the soil, by the use of WAKSMAN methods; and the detailed descriptions of their experiments, which for various reasons are not fitted for abbreviation, form the bulk of this paper, and are followed by a rather generalized and inconclusive application to Louisiana conditions at the end. Unfortunately for the reader, the presentation of these descriptions is marred by many cases of careless proof reading; the tables are sometimes difficult to understand, and the reader is particularly handicapped in appreciating some of the results, because of the absence of the charts referred to in the text, which were " lost in submitting the proofs for correction."

The investigation is outlined as follows : The various constituents of cane trash, the rate of decomposition of these constituents, the effect of age of trash upon the numbers of micro-organisms in the soil, the effect of trash upon cane growth, the effect of trash upon moisture retention in the soil, and the agronomic phases of trash disposal. This is a large programme, and it is to be hoped that the authors will see their way to deal more fully with each of these subjects in a separate communiction at some future period. Only one or two can be noted here.

The various constituents of cane trash.—Cane trash is, in these experiments, the term applied to dead leaves finely powdered. This material was submitted to various solvents, to determine the proportion of the different constituents of the leaves and their various rates of decomposition. The ether extract (0·9 per cent.) comprised the waxes and fats : these decompose slowly, and their removal accelerates the decomposition of organic matter in the soil.

Moisture was determined as 3·6 per cent. The water soluble fraction (6·08), consisting of sugars, some of the starches, amino acids and soluble proteins, is on the other hand very readily decomposed, and its removal tends rather to retard decomposition of the plant material by most of the groups of bacteria and fungi in the soil. The alkali fraction (51·9) contains a considerable portion of the lignins and a part of the hemicelluloses, and its removal tends to increase the rate of decomposition. The acid fraction (9·2) contains the remaining hemicelluloses, but their removal makes little difference in the rate of fermentation, as they decompose at about the same rate as the residual cellulose (25·9 per cent.).

The carbon-nitrogen ratio of the trash.—The harvest of sugar cane in Louisiana is given as lasting from October to January, after which the residue of dead leaves remains on the fields slightly covered with soil. The ratios were determined in samples collected from the fields of the Experimental Station at successive periods as follows : fresh trash 45·62 : 1, in January 42·86, in February 37·5, and in April 23·4.

The repressive action of cane trash upon soil nitrates.—This was determined by filling wide-mouthed bottles with sieved soil, and mixing in portions of finely divided fresh trash or KNO_3, either separately or both together. The mixture was brought to a moisture content of approximately 60 per cent. saturation and kept at that. The first experiment consisted of three series of bottles as follows : 200 grms. soil, in *A* with 0·2 grms. KNO_3 and 2 grms. trash, in *B* with only the nitrate, and in *C* with only the trash. There were six samples in each series, and thus 18 altogether. "Two of the samples from each series were analysed at each period of analysis and the remainder were treated with additional amounts of nitrates and moisture. The object of the experiments was to determine the following facts : (1) the rate of depression of fresh trash upon nitrates, (2) the time required to overcome this depression when the trash is accompanied by nitrates, and when the latter are unsupplied."

The results of this experiment are summarized as follows : "(1) There is a considerable loss of nitrates in the presence of trash even within the first week following its application. (2) There was a loss of total nitrogen only in one case and it was very small, while in every other instance there is a gain in nitrogen over and above the amount added in the successive applications of nitrates. (3) Without the addition of nitrates the trash had lost but little if any of its nitrate depressing action even after five weeks. (4) Series *A* after eight weeks and four applications of nitrates still showed a depressing action."

The influence of cane trash upon plant growth.—Passing over the many interesting experiments between, we naturally turn to this corollary to the above. In order to determine the time required for trash to decompose sufficiently in the soil as not to utilize the available nitrogen at such a rate as to hinder plant growth, the following experiment among several others was laid down. Portions of sifted soil weighing 5 kg. were placed in 12 unglazed earthenware pots, and all but two received 100 grms. of finely divided cane trash, and all were watered to a moisture content of 60 per cent. water capacity. These pots were not thus prepared all at once, but two each fortnight, so that the trash and soil in them were mixed for different periods of time, i.e., two each for 8, 6, 4, and 2 weeks, before sowing, which took place a fortnight after the last two pots were prepared. Maize was sown in each pot, and when the young plants were 4-5 ins. high these were thinned to four in each pot, and two weeks later all the pots received 200 c.c. of a solution containing 37·3 grms. of $NaNO_3$ and 24·29 grms. of acid phosphate. The pots were placed in a

greenhouse and watered daily ; the heights of the plants were measured at frequent intervals, and their green and dry weights determined at the end.

The results, illustrated by Tables and a Chart (missing), show that the greatest average dry weight was reached by the two plants sown 8 weeks after the trash had been added, and the rank in weight and height of the whole varied directly with the interval between the application of the trash and sowing. This is best shown in the Chart, in which it may be observed that there was a lag period in growth in all the series, following the application of the fertilizer, excepting in the no trash and the 8-weeks trash pots. Evidently there was sufficient energy in the others to induce a rapid exhaustion of the food supply in the soil, resulting in a temporary inhibition of plant growth.

THE TRANSMISSION OF STREAK DISEASE BETWEEN MAIZE, SUGAR CANE AND WILD GRASSES. **H. H. Storey and A. P. D. McLean,** *Annals of Applied Biology*, Vol. XVII, No. 4. November, 1930.

The gradual unfolding of the history of this virus disease of the Uba cane, as reported by STOREY its discoverer, has been somewhat fully reported in these columns.[1] Streak differs from mosaic in its external signs, both in maize and sugar cane, the leaf markings consisting of fine, clear, parallel, broken lines along the fibrovascular bundles. After some study, it was found to be carried from plant to plant by a leafhopper *Cicadulina* (*Balclutha*) *mbila*, and has been artificially transmitted from maize to maize and sugar cane to sugar cane. The present paper carries the study further and, among other things, describes the effects produced by transmitting the virus from maize to cane and vice versa. The sugar cane virus caused a permanent but mild form of streak in the maize, while that from maize to sugar cane effected only a transient infection from which the cane plant recovered. The passage through the second host, moreover, does not appear to change its virulence to its original host plant ; and hence the authors have come to the conclusion that the two viruses are not identical. Experiments in transmission to certain grasses give results which are puzzling, but which confirm this differentiation of the viruses. Also, POJ 213, which was formerly regarded as immune, proves not to be so, but yields information as to the behaviour of a cane variety with high resistance.

The paper, which is of a most painstaking and thorough-going character, is divided into the following sections : Introduction (noted above) : methods ; streak virus from maize ; streak virus from sugar cane in Uba ; in POJ 213 ; in other canes ; and in wild grasses ; summary of experiments ; the over-wintering of the streak virus of maize in Natal ; discussion, and general summary ; appendix with a list of 25 other leafhoppers unsuccessfully tested for transmission.

The methods of transmission as yet devised are all through *Cicadulina mbila*. The multiplication and manipulation of the insects involved much study and labour, but the use of the small leaf-cage method permitted of a reasonable replication of experiments in the space available. With a group of hoppers, an 8 in. by 1 in. glass tube was used, into which the tip of a leaf could be introduced ; with single hoppers small bits of glass tubing were clipped on to the leaf ; and in certain grasses it was found convenient to enclose the whole plant in a lamp chimney. All the experiments were made in a greenhouse with gauze-protected ventilators and proper precautions against insect infestation. The maize plants were raised from seed, and the cane plants

[1] See *I.S.J.* 1924, 583 ; 1925, 484 ; 1926, 300 ; 1928, 479 ; 1930, 212.

from sets from a field with a very low percentage of streak; and in both cases an equal number of plants were raised from the same sources in an adjacent greenhouse. These precautions appear to have been satisfactory, for in the tables of infection results, the entries in the control columns are invariably "Nil."

Streak virus from maize.—The transmission of streak from maize to Uba was by hoppers which had been bred under controlled conditions. Of the various experiments conducted, two are here given. In the first, where hoppers were fed in small glass tubes on the cane leaves, a few streaks or doubtful ones were observed on 15 out of 34 cane plants, but in no case was the infection permanent, although the plants were kept under observation for from 61 to 340 days. As it was considered conceivable that the method was in some way at fault, a leaf-cage test was conducted, as nearly as possible to field conditions, with 48 Uba plants and 72 maize seedlings. All of the latter were infected, and after 60 days were cut down and left to dry; and, later, numbers of hoppers were seen to have migrated to the canes and to be feeding on their leaves. The canes were all healthy, save for one or more streaks but, after 240 days when the experiment concluded, all the young leaves were free from any streaks.

During these and other experiments it was frequently observed that one or more rarely several, large, isolated, chlorotic spots were present on the young cane leaves, usually appearing from two to three weeks after exposure to infection. That these spots contained active virus was proved by infecting maize leaves from them, with the result that fully normal streak appeared on them. After the appearance of these spots on the young cane leaves, all subsequent ones during the period of observation were completely free from streaks. When hoppers fed on these spots were placed on cane leaves, the result was negative, showing no indication that the virulence to cane had been increased by passing the maize virus through the sugar cane.

Streak disease from sugar cane.—The signs of streak in Uba have been repeatedly described: they differ from those in maize in that the streaks are sparser and narrower, and the two can be easily distinguished. Various successes have been obtained in transmission by hoppers, the first streaks appearing in from 2 to 3 weeks, and increasing in frequency with successive leaves until the youngest are indistinguishable from the naturally streaked plant. Young, secondary shoots often make their appearance already fully streaked.

When infected leafhoppers are fed on maize, a disease is produced resembling streak in cane; the chlorotic areas are narrower and sparser than in maize streak. With the growth of the plant, however, successive leaves have ever sparser markings, till the youngest have very few; but no case of complete recovery has been met with during the short life period of the maize plant. The signs of cane virus in maize are, indeed, often so insignificant as to escape notice in the field; although the authors have met with it on maize growing near to streaked Uba. A similar tendency towards suppression has been noted in maize infected by maize virus; but again, no case has been observed where the sparseness of the streaks reached that in maize plants infected by cane virus, nor did they become so narrow.

The incubation period of cane virus in maize plants is usually longer than it is in maize virus, i.e., about 8 days to 12-17 days. In an experiment, cane virus was passed through six series of maize plants, the most severely infected plant in each series being used for transmission to the next. This passage

through maize was not found to increase its virulence to maize, nor to have any effect on its virulence to sugar cane when it was re-transmitted at the end of the experiment. Hoppers appear to be able to carry both viruses at the same time ; when infected with one virus they can take up the other, and maize plants infected by maize virus can afterwards be infected with cane virus.

POJ 213 was in 1925 reported to be immune from streak, but in 1926 clear symptoms were met with in one stool ; and, for three years after, this stool continued to produce some healthy and some diseased shoots. In 1928 and 1929 further cases were noted, also producing healthy and diseased canes. This behaviour plainly shows instability of infection in this cane variety, and similar instances have been described by STAHL and FARIS. After detailing the various experiments in transmission from diseased Uba to this cane, the authors remark that it is not clear why so many failures have been met with. The disease was transmitted from POJ 213 to maize with similar results to those obtained with virus from Uba.

In a former paper 11 varieties of cane were mentioned as susceptible to streak, and six more are now added. A number of new importations of cane varieties have been tested by the large cage method and the following are noted provisionally as immune : Cos. 205, 210, 213, 214, Toledo, Hinde's Special, Kassoer and Kinar. The list of wild grasses showing streak has been increased from 16 to 22, all of them having been diagnosed by characteristic markings in the field. Only two are examined experimentally in this paper, *Digitaria horizontalis* and *Eleusine indica*, full details of which are given. One result of these investigations on wild grasses is that it appears improbable that the disease in maize is handed over from one crop to the next by harbouring in them ; aud the authors have noted cases of over-wintering in odd leaf-hoppers. The paper is illustrated by a series of very clear photographs of the various leaf markings met with in the different hosts dealt with.

C. A, B.

News Letter of the Activities of the International Society of Sugar Cane Technologists.

Porto Rico Congress.—Preliminary arrangements for the San Juan Congress are proceeding apace. In order to add to the interest of the international gathering and make the Congress more instructive, the local committee, in co-operation with the Department of Commerce of Porto Rico, is planning a manufacturers' exhibit of machinery and supplies for sugar estates. A meeting has been called in Porto Rico for the purpose of launching this project. Firms that wish to take part in this exposition are invited to address the Local Secretary of the Society, Mr. MANUEL A. DEL VALLE, Central Constancia, Toa Baja, P.R.

Cane Variety Collection.—Another important attraction offered the Society is the cane variety garden now being established in Porto Rico under the direction of Dr. E. W. BRANDES by the U.S. Department of Agriculture. It should again be emphasized here that the purpose of this collection is to offer an opportunity for botanical study of the original and other important cane varieties, but that it is not to be used as a source of seed cane.

Manuscripts.—All the reports and papers to be presented at the San Juan Congress should reach Mr. MANUEL A. DEL VALLE, Central Constancia, Toa Baja, Porto Rico, by October 1st, 1931, so that there may be sufficient time for preparing preprints to be distributed before or at the opening of the

Congress. All the Committee chairmen and authors of papers are requested to assist the Local Secretary by sending in their manuscripts as early as possible.

Membership.—It is very gratifying that we are able to report a total enrolment of 286 subscribed members at the time of writing. The total membership for the previous three-year periods is not known, only the names of members who actually attended the three Congresses having been published. The number of attendants at the Honolulu Congress, when the Society was founded, was 45, at the Havana Congress 159, and at the Soerabaja Congress 144. At the present time thirteen regional sections have been officially organized. In nine geographical divisions, Cuba, Hawaii, Holland, Natal, Peru, Porto Rico, Queensland, Réunion, and United States (exclusive of Louisiana) we have twenty or more members each, while there are smaller Sections in Colombia, Egypt, India, and Santo Domingo. Réunion has 25 members.

M. GUILLAUME has accepted the vice-chairmanship for Indo-China, vacated by the resignation of P. VIEILLARD, and is now enrolling members there. J. P. OGILVIE has consented to organize a Section, as vice-chairman for the United Kingdom. H. ATHERTON LEE takes over the Philippine Section. The Java Section is at present being organized by a committee headed by E. C. VON PRITZELWITZ VAN DER HORST, and with A. VAN LEER as Secretary.

Technical Committees.—T. S. VENKATRAMAN (India), Chairman of the Committee on Varieties, has added the following technologists to his Committee : R. A. BOURNE (U.S.A.), G. BREMER (Java), W. E. CROSS (Argentina), H. H. DODDS (Natal), H. T. EASTERBY (Queensland), G. M. FORTUN (Cuba), F. A. LOPEZ DOMINGUEZ (Peru), N. B. MENDIOLA (Philippines), NAND LALL DUTT (India), A. H. ROSENFELD (Louisiana), and D. L. VAN DINE (Cuba). The Committee will collect data on the characteristics of the seedlings raised rom different parents, including wild Saccharums, comprising such characters as vigour of growth, and resistance to various diseases ; on the conditions of arrowing and for arrow fertility ; on the technique employed in the pollination and in the growing of the seedlings ; on the methods of selection and elimination as practised in the different countries.

R. FERNANDEZ GARCIA (Porto Rico) has been appointed Acting Chairman of the Committee on Cultivation and Field Operations, and MELVILLE T. COOK (Porto Rico) Acting Chairman of the Committee on Diseases.

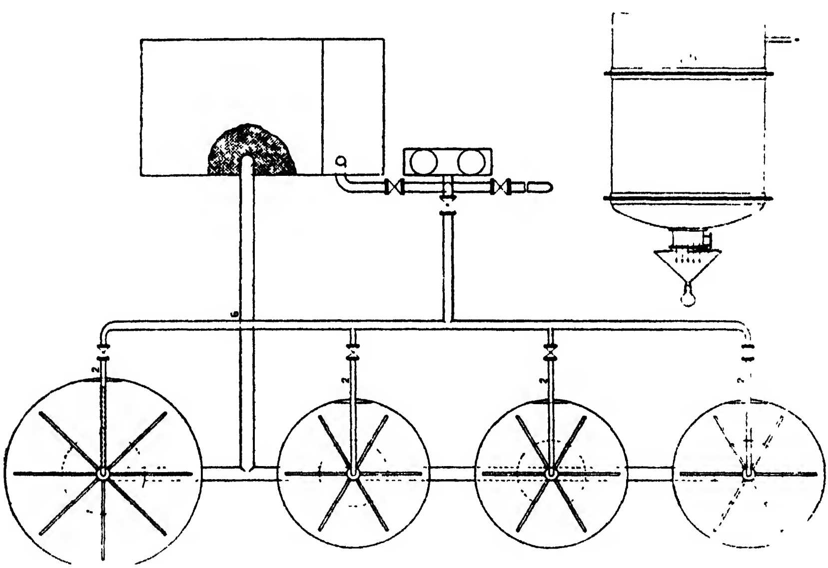
The Chairman of the Committee on Uniformity in Reporting Factory Data sent out Questionnaire No. 4, on methods of analysis, on December 29th 1930. Questionnaire No. 2, on methods of boiling house control, has been returned by 12 out of a total of 14 committee members to whom it was sent. These replies have been compiled and will be mimeographed for reconsideration by the Committee at the San Juan Congress. Questionnaire No. 2, on methods of weighing, measuring and sampling, has so far been sent back by only six members, while eight replies remain outstanding. Replies to all Questionnaires, No. 2, 3, and 4, must be in the hands of the Chairman by July 1st 1931, in order to be considered in the report of the Committee to be presented at the San Juan Congress.

SOUTH AFRICAN SUGAR PRODUCTION. The latest estimates to hand from Durban of the South African sugar production for 1930-31 put the total tonnage of sugar at approximately 390,136 short tons, which compares with 288,635 tons in 1929-30. The number of factories in operation was 24.

Java Technical Notes.

Rapid Cleaning of Heaters, Evaporators, Pans, etc., using Caustic Soda. A. Feringa. *Archief,* 1930, **38**, I, No. 14, 330-335.

A description is given of a method of operating for the removal of scale from heaters, evaporators and pans by spraying with a strong solution of caustic soda, this being on the same lines as the procedure elaborated by Clarke in Hawaii.[1] As seen, the lay-out consists essentially of a storage tank connected to a pump which in turn supplies rotary spider sprayers placed inside the vessels to be cleaned, the capacity of this tank being somewhat greater than that of the piping, the pump, and the spraying device. Under each vessel is a funnel leading to the pipe returning the caustic liquor to the storage tank, where before entering it passes through fine gauze to screen off the insoluble matter which it has carried along. Operation in the case of an evaporator is as follows : It is emptied ; water is pumped in so as to remove loose scale ; the sprayers are introduced through each manhole and fixed ; the lower manholes are opened and the funnels placed beneath each. Following this, concentrated 40°Bé. caustic soda liquor is circulated through the system for two hours. During this time the sprayers revolve, and the caustic soda solution falls in a rain over the tube-plates of the steam-drums,



running through the incrusted tubes in a continuous thin layer, and penetrating the scale. At the end of the period named, the flow of soda is stopped, and water is turned into the same spraying system. Finally the cleaning apparatus is removed ; the evaporators again washed out with water ; and the tubes dry-steamed. During this last operation, much of the scale falls from the tubes, following which it can be entirely removed by means of ordinary brushes. In the Waroe s.f. (where the author is engineer) a stoppage of 11-12 hours every week sufficed for the application of this method so as to keep the quad in a clean condition. Other points made in the paper are : After each cleaning, the soda liquor requires to be made up to 40°Bé. again ; a cast-iron Frank Pearn pump with copper valves, plungers, etc., and a

[1] *I.S.J.*, 1929, 674.

capacity of about 400 litres (88 gallons) per min. is used; a temperature of 80-90°C. suffices with 2 hours' circulation to remove scale 1 mm. thick. This method of removing scale appears to be of much interest. It seems likely to be capable of giving similar results generally. It is claimed to be more rapid than the ordinary method of boiling out, and to consume less caustic.

DETERMINATION OF UNKNOWN LOSSES IN JUICE PURIFICATION (USING DIFFERENT DOUBLE POLARIZATION METHODS). **J. Boers.** *Archief*, 1930, **38**, II, No. 32, 745-754.

The object of the present investigation was to carry out a series of analyses in the laboratory in order to ascertain whether a closer insight could be obtained into cases of unknown losses of sucrose during juice clarification, using different double polarization methods of determining the sucrose. The sucrose was determined by the following four double polarization methods: (*a*) the STEUERWALD[1]; (*b*) the CLERGET-HERZFELD[2]; (*c*) the invertase[3]; and (*d*) the DEERR[4] method. Applying these methods to various samples of raw juices from different canes, the following is an example of the average results obtained: Direct polarization, 15·44; STEUERWALD, 15·78; CLERGET-HERZFELD, 15·83; invertase, 15·79; and DEERR, 15·71. Following this, a quantity of raw juice was clarified by rapidly heating it to 75-80°C., liming and sulphiting simultaneously, finishing at 6·7 *pH*; heating to boiling point, subsiding, and filtering over a layer of "Hyflo" under vacuum. A sucrose balance was drawn up; compared with 100 of raw juice, the gain or loss of sucrose in the clarified juice using the direct polarization and also the same four methods of analysis, was found to be: direct polarization —0·37; Steuerwald, —0·51; Clerget-Herzfeld, —0·65; invertase, —0·74; and Deerr, +0·37. Applying the simple defecation method of clarification, the average results of three balances were: direct polarization —0·20; Steuerwald, —0·76; Clerget-Herzfeld, —0·03; invertase, —0·98; and Deerr, +0·20.

Following this similar determination were made with juices under different circumstances. For example, to two juices 10 per cent. of soil was added to see if this would have any effect on the extent of the sucrose loss after clarification by sulphitation, and here are the results obtained:—

Pol.	*S.*	*C — H.*	*I*	*D.*
— 0·36	— 0·49	+0·08	—0·63	— 0·30
— 0·98	— 0·18	—0·91	—	— 0·64

In two other cases the sulphited juice was held during 1½ hours at boiling point, when it was found a considerable loss had occurred, namely 1·56 and 2·09 respectively per 100 pol. Then some POJ 2878 canes, 10 months old, were kept after cutting for eight days, ground, and the juice submitted to sulphitation clarification. Two tests were made. In the first, clarification was as usual; but, in the second the defecated juice was held for 1½ hours at boiling point previous to subsiding:—

	Pol.	*S.*	*C — H*	*I*	*D*
Test I	+0·39	+0·43	—0·51	+0·84	+2·09
Test II	—0·25	—0·70	+0·17	—	—0·50

It seems probable, says the author, that after all in normal cases the unknown losses are not due to chemical losses during the process of juice clarification, or only so to a small extent. Rather should they be attributed to mechanical losses at the filter-press station, and by entrainment in the last

1 "Handboek" I. Page 85. That is, inverting in the cold, using 3 times the amount of HCl as ordinarily. *I.S.J.*, 1913, 489. 2 *Ibid.*, Page 80. That is the ordinary double polarization method.
3 Use was made of the lead-free solution; ½ n.wt. being inverted with 1 c.c. of invertase solution.
4 "Methods of Chemical Control for Cane Sugar Factories and Gur Refineries." p. 29 *et seq.* See *I.S.J.*, 1930, 419.

body of the evaporator or the pans, though it seems certain that during the boiling process and the sulphitation of the evaporated syrup chemical losses do take place.

FACTORS INFLUENCING THE ASH CONTENT AND SUGAR RECOVERY. **J. G. Thieme.** *Archief*, 1930, **38**, II, No. 31, 713-727.

During the 1929 season some factories in East Java produced molasses of a very high purity, notwithstanding their modern equipment, which should have led to a better result. Even after exhausting such molasses in the laboratory as far as could be done, purities remained high, which was traced to an abnormal composition of the non-sugars, especially in inorganic matter. This being a subject which has been little investigated, a systematic examination was made of the factors which throughout manufacture bear on the increase of ash. Firstly, as regards milling, PRINSEN GEERLIGS has pointed out the effect of more intensive milling on increasing the ash; but in order to bring this influence up-to-date figures were obtained for two installations, each consisting of a crusher and four mills, the ash being determined in the different juices, and results calculated as the "ash per cent. non-sugars." This value was found to rise distinctly from crusher to fourth mill juice, though after all this increase cannot be of much significance, when one considers the relatively small amount of juice which is expressed by the later mills. Secondly, as regards clarification, samples of raw juice and syrup were collected from all the H.V.A. factories, filtered, and ashed. In the defecation factories the rise in the inorganic non-sugar was 9·14; and in the sulphitation factories 13·4 per cent.; but in carbonatation factories there was a fall, namely of 11·73 per cent. Going further into this, it was found that the ash concerned was mainly lime. Thus the CaO increase as the result of defecation was 132·2 per cent.; in sulphitation, 304 per cent.; but in carbonatation only 20 per cent. At the filter-presses of sulphitation and carbonatation factories, the ash re-entered the juice, as it was dissolved out during the washing of the cake; but the amount concerned after all, considering the relatively small volume of the sweet-waters, must be insignificant. During evaporation the ash per cent. non-sugars falls, due of course to scaling. Between evaporator syrups and molasses, there is a marked fall recorded, namely 3·5 per cent. for defecation and 0·58 for sulphitation factories; but this cannot be due entirely to the small amount of ash removed by the sugars. A good part of it is apparently due to the Brix being determined by the 1/10th dilution method, this leading to a low result for the ash per cent. non-sugar.

However, while a greater or less amount of ash may be taken up during manufacture, the main factor is to be found in the conditions under which the cane is grown. Here. for example, are the ash factors since 1925 :—

1915	1917	1918	1919	1920	1921	1922
18·4	18·9	19·3	19·7	19·9	19·7	19·5
1923	1924	1925	1926	1927	1928	1930
20·3	20·3	20·2	20·8	21·3	22·7	24·2

On plotting these values, a sudden rise is shown during 1926-29. Now this period coincides with the introduction and rise in the cultivation of POJ 2878; and it would seem as though a high ash per cent. of the non-sugar were a property of the juice of that cane. During 1922-23, and 1925-26 there were also sudden jumps. Now it was during the years 1923-1926 that the sugar yield per hectare was smaller than during the previous periods, traced as the result of abnormally small rainfalls. It would seem that dryness leads to a

high ash content. Interesting results were also provided by studying the geographical situation of factories having unusual ash factors, and it was shown that in the molasses of factories in the more arid parts of Java the highest ash values are to be found.

DETERMINATION OF THE QUANTITY OF CAUSTIC SODA NECESSARY FOR EVAPORATOR SCALE REMOVAL. **L. J. H. Pagnier.** *Archief*, 1930, **38**, II, No. 47, 1071-0174.

In the Tegowangi s.f. it is the custom to add fresh NaOH from time to time to the tank containing the caustic soda liquor used for boiling out the evaporators, the quantity to be added to bring it up to strength having been determined in 1929 by a simple titration with standard acid, using phenolphthalein and methyl orange. (*Ed. Note.*—This routine alkali works method is carried out by titrating 50 c.c. of the solution with N/1 HCl until the red of the p.p. just disappears, adding m.o., and continuing the addition till the yellow colour changes to pink ; then if n c.c. are required for the first part of the titration, and m c.c. for the second, $2m$ = the Na_2CO_3 present, and $n - m$ = the NaOH). However, it was found that the tubes, especially those of the second body, became more difficult to scrape, so more caustic had to be added to the tank than corresponded to the titration figure. Incidentally, after carrying out the titration in the laboratory it was noticed that the neutralized liquid had set to a solid gelatinous mass, from which it was apparent that rather considerable amounts of silicate were concerned, an analysis made by the Central Laboratory of the H.V.A. in fact showing the following results as the composition of the cleaning liquor : Na_2SiO_3, 46·8 ; K_2SiO_3, 4·8 ; K_2SO_3, 8·8 ; K_2SO_4, 5·9 ; KCl, 2·3 grms. per litre. What was being titrated, therefore, was practically a solution of water-glass, in which case an acidimetric titration as used could hardly be expected to give anything like an accurate indication of the free alkali actually present, results for the NaOH much too high being obtained. Accordingly, a procedure described by HEERMANN[1] was applied, in which a suitable volume of the cold soda solution was mixed with an $N/1$ solution of barium chloride to precipitate the silicate, made up to 250 c.c., filtered, and 100 c.c. of the filtrate titrated with $N/10$ HCl, using p.p. This method was satisfactorily applied during the 1930 campaign for ascertaining the free NaOH in the alkali tank before and after boiling out the evaporators. Its use demonstrated the very considerable amount of silicates being removed from the scale of the sulphitation factory named ; in fact an analysis of the tank liquor showed it to consist mainly of Na_2O, K_2O, SO_3 and SiO_2, there being traces only of CaO and MgO present.

PRESENCE OF SACCHARATE IN THE MUD OF SULPHITATION FACTORIES. **L. J. H. Pagnier** *Archief*, 1930, **38**, II, No. 50, 1139-1141. It was found at Tegowangi s.f. that badly slaked lime had been used ; and, fearing the possibility of some formation of saccharate, samples of the filter-mud were polarized with and without the addition of acetic acid (as is done in beet factories). Rather marked differences in polarization were observed, such as : 4·5 and 4·2 ; 6·1 and 5·1 ; 2·8 and 2·1 ; 2·7 and 2·4 ; 2·6 and 2·3. Similar results were observed in a sister factory, the pol. in the presence of acetic acid being about 25 per cent. higher than without it. It is concluded that sulphitation factories must take into account the possibility of saccharate formation, or at any rate of the presence of an insoluble form of sugar, not to be determined by the ordinary method.

[1] *Chemiker Zeitung*, 1904, 879 and 883.

Abstracts of the International Society of Sugar Cane Technologists.

Under the scheme proposed by the Intern. Society of S.C.T., a collection of abstracts of papers on agricultural and technical subjects is being issued. A selection has been made by us from the material which has been sent to us, and appears below :—

Beet Sugar Manufacture.

Effect of Non-Sugars in Refined (Beet) Sugar on the Caramelization Test. **J. Pucherna.** *Zeitsch. Zuckerind., Czechoslov.*, 1930, **55**, 143-151.

An improvement on the caramelization test devised by Lunden and by Spengler and Tödt is : 6·5 grms. of the sugar are dried for 2 hours at 100°C. and placed in test-tubes (16/160 mm.). These tubes, in series of four, are immersed for 15 minutes in an oil-bath previously heated to 170°C. On removal from the bath the tubes are cooled ; the contents of each dissolved in water and made up to a volume of 50 c.c., filtered, if necessary, and the colour determined, preferably by the Sandera objective photometer. Colour thus observed is called primary. Secondary colouring effects are produced by adding 0·5 c.c. of 2/N-NaOH solution and heating for 10 mins. on the water bath, after which the colour is again determined. Indifferent substances, such as neutral or slightly alkaline salts (except ammonium salts) of organic or inorganic acids cause little primary coloration. Substances which cause noticeable primary but little secondary coloration are principally amides and salts of amino acids. Those producing much primary colour and a still more marked increase in secondary coloration include chiefly ammonium salts, calcium chloride, and the chlorides of betaine and glutaminic acid.

Hygroscopicity of (Beet) Sugars as affected by Occluded or Adhering Substances. **M. Garino.** *L'Ind. Sacc. Italiana*, 1930, **23**, 483-486.

Commercial granulated beet sugar, was crystallized from solutions of caramelan, caramelen and the ammonium, calcium and potassium salts of glucic and apoglucic acids. The crystals were examined as to hygroscopicity and contamination with the above named substances. The author's conclusion is that of the substances which normally accompany beet sugar, only caramelan is distributed in any notable quantity in the body of the crystal ; the others here considered are found only in traces within the crystal network. Also caramelan is the substance which chiefly confers hygroscopicity on the sugar, although this defect in the case of beet white sugar may be due to a very thin coating of calcium chloride.

Chlorinating Waste Water. **Nolte et al.** *Deut. Zuckerind.*, 1930, **55**, 42 & 43, 1129-1130, 1156-1157.

Various large scale experiments on the chlorination of waste waters from beet sugar factories before discharging into public water courses are discussed. Some factories are now solving their waste water problem in this way with generally satisfactory results, although various questions invite further investigation. The amount of chlorine needed varies from 4 to 10 grms. per cub. metre ; more is required when the beets are grown in sandy soil than in clay soil districts. The water may be chlorinated continuously or intermittently ; in intermittent chlorination the settling pond is left to itself until the presence of hydrogen sulphide is observed, when the entire quantity of water is again chlorinated. This process seems to be the most economical of chlorine and hence involves the least expense. In some cases chlorine is used in the form of sodium hypochlorite, which is easily prepared and is

slower acting, which is of advantage to the economy of the process. Instances are given where the factory has been enabled to re-use the same flume water for 100 days ; foaming of this water was prevented by the use of a small quantity of oil. In another case a factory chlorinated all its water except the condenser water, and was even able to use the treated water in the diffusion battery.

REMOVING FOAM FROM CONTINUOUS LIMING TANKS. **F. Paulik.** *Zeitsch. Zuckerind. Czechoslov.*, 1930, **55**, 141-142.

In a liming apparatus consisting of three mixing tanks connected in series the juice is deflected by baffles to the bottom of each tank, while the foam is swept by a revolving scraper into a trough, leaving the surface of the juice free. Foamless juice and foam are subsequently united in the carbonatators, but under these circumstances no new foam is produced during the carbonatation, and hence no anti-foam oil or fat is needed. This device has been found very satisfactory.

FLUE-GAS UTILIZATION. **M. Stuntz et al.** *Centr. Zuckerind.*, 1930, **38**, 1113-1115.

The author has worked out a heat economy system for sugar factories working by the pressure evaporating system, which consists in employing the hot condensate from the evaporators and pre-heaters for warming up the raw juice. After serving this purpose the water is sent through an economizer to be reheated by the waste heat of the chimney gases for re-use as boiler feed water. A heat balance calculation shows that when this system is introduced into a pressure evaporation plant working 1000 tons of beets a day in a campaign of 80 days, there will be a saving of 1030 tons of coal with a heat value of 7000 calories in comparison with warming the raw juice by means of vapour. According to the speaker, this is a better use for waste heat than for pulp drying, which should be taken care of by a separate installation. In the discussion H. CLAASSEN suggested that the STUNTZ idea could be improved on by means of a closed circuit through which water circulated first through an economizer placed in the hot chimney gases and then through the juice warmers and back to the economizer. Another speaker referred to a Bohemian sugar factory where four high power water-tube boilers were installed, working at 32 atm. over-pressure, and behind each a low pressure boiler (Ohlbricht system). The flue gases leave the water-tube boiler at 340°C. and the low pressure boiler at 215°C. (419°F.). These low pressure boilers deliver steam at 5 atm. over-pressure which upon suitable reduction can be used directly in the first evaporating effect.

STANDARD PROCESSES FOR BEET SUGAR MANUFACTURE. **I. Belousoff.** *Sovietskii Sakhar*, 1930, No. 19, 1013-1018.

In the long process for working up to 160 days, one operates as follows : The first defecation is continuous, and regulated so that the juice is in the defecators 10 to 20 mins. The first carbonatation is effected alternately in one of two carbonatation tanks, the alkalinity being reduced from 0·08 to 0·01 ; the temperature not being allowed to exceed 95-98°C. to avoid decomposition and resolution of albuminoids. The juice is filtered and passed to the second carbonatating station, which consists of two tanks : in the first lime (0·25 per cent. CaO) is added, and carbonatation to the optimum alkalinity effected at 101°C. in the second. It is then heated to 102-103°C. in quick-acting juice-heaters and passed to the juice-boiler, where it stays 15 mins., after which it is sent through a filter-press and a mechanical filter. It is next sulphured to a weak alkaline reaction, filtered through a mechanical filter, again heated in a quick juice-heater, and passed to the evaporators.

In the short process for a 100-day campaign defecation is as in the long process with the exception that the alkalinity of the first defecated juice is 0·04-0·05. A juice-heater is included before the filter-presses, as in the long process. The first saturation-sulphitation is as in the long process; minus the juice-heater. The sulphured juice is re-heated and filtered through the filter-press; it passes the juice-boiler and mechanical filter, and finally the juice-heater in front of the evaporators. Evaporation in both processes will be by the pressure system. The evaporated juice will be worked as standard syrup according to the "American practice." The first fillmass (massecuite) is made up of thick-juice and affined *B* and *C* sugars; but this re-melt mixture is treated with decolorizing carbon and receives an addition of run-off from a previous first fillmass. Only one syrup, of purity about 90°, is collected from the first fillmass; it will be treated with carbon, and one part will be boiled to second fillmass while the other part will be used to make up the next first fillmass. The *B*-fillmasses give *B*-sugar and two run-offs; the first of these is boiled to *C*-fillmass and the other is used in preparing the second fillmass. *C*-fillmass and the other are used in preparing the second fillmass. *C*-fillmass gives *C*-sugar and final molasses.

Cane Sugar Manufacture.

Advances in the Cane Sugar Industry. **G. P. Meade.** *Chem. & Met. Eng.*, 1930, **37**, 745-750.

This is an address before the 1930 meeting of the American Institute of Mechanical Engineers, outlining recent developments of chemical engineering in the cane sugar industry, most of which is already familiar to readers of the *I.S.J.* Among the most important are the growing use of improved crushing and shredding equipment in the grinding station, the introduction of strainerless juice pumps for maceration juice and water, realization of cleanliness at the grinding station, a greater appreciation of colloid chemistry in juice purification, and the use of *pH* control. Colorimetric *pH* tests have become general and electrometric recording instruments are also in use. A further refinement of clarification is promised to the continuous determination of dissolved lime salts by conductivity methods. A radical departure from old methods is the use of the Dorr clarifier as an adjunct of the Petree-Dorr system, of which system double defecation is a feature. This eliminates the ordinary plate-and-frame filter press station. Pressure filtration of the clarified juice and thick-juice after addition of inert filter aids results in greatly improved or direct consumption sugars. Pauly-Greiner pre-evaporators are being used in some cane sugar houses, when steam economies have reduced exhaust steam below boiler-house needs. Crystallizers have been equipped with cooling coils for the more rapid working of low-grade products. Self-discharging centrifugals are now in great favour in the raw cane sugar industry. In refinery work, the pressure filters of the Kelly, Sweetland, and Vallez type are now generally used in connexion with inert filter-aids, although hardly any two refineries employ the same technique at the filter station. There has been a distinct advance in the handling of char filters by the introduction of "wet-filling," which consists in filling the filter with char and liquor simultaneously, instead of char first and liquor afterwards. Activated carbons are chiefly used for sugar refining in the tropics. In one refinery continuous filters of the Oliver type have been used successfully for separating crystals and syrup, instead of centrifugals. Sugar screening is now done almost entirely by vibrating screens of the "Hummer" or "Newaygo" types.

MANUFACTURE OF INSULATING BOARD FROM CORNSTALKS. **O. R. Sweeney and W. E. Emley.** *Bureau of Standards, Miscellaneous Publication No.* 112.

Pursuant to an Act of Congress, the Bureau of Standards has made an engineering study on a semi-commercial scale of the manufacture of wood substitutes and fibre from corn stalks. This illustrated bulletin of 27 pages describes the experimental work on the manufacture of insulating board from cornstalks, from the first laboratory experiments through to semi-commercial production, giving details of different ways of making pulp from cornstalks and different types of equipment used to make board from the pulp. It also estimates in detail the capital and operating costs for a commercial factory, and analyses probable markets for insulating board. NOTE.—As cornstalks will come into competition with cane bagasse for fibre board, this publication will be of interest to the cane industry.—ED.

INFLUENCE OF BAGASSE ANALYSIS ON THE SUCROSE CONTENT OF CANE. **E. Haddon.** *S.A. Sugar J.*, 1930, 741.

The author quotes various authorities whose work indicates that the increase in the polarization of bagasse is due to the presence of optically-active substances derived from the hydrolysis of hemicelluloses. To prevent this hydrolysis the author states that it is absolutely necessary that the boiling of the fibrous substance, which may be bagasse, pulp, or beet chips, be effected in the presence of barium hydrate, the liquid being maintained alkaline to phenolphthalein paper.

Trade Notices.

Worthington Pumps.—From the Worthington Pump & Machinery Corporation come two recent catalogues of their specialties. One deals with Axiflo, Hiflo and Coniflo rotating shaft pumps for deep well, sump and irrigation service, the three types being designed to cover the varying range of these pumping requirements. The largest, the Axiflo, will deal with wells 12 ins. or more in diameter. The other catalogue covers Vertical Triplex Single Acting Power Pumps, which for higher pressures and lower capacities, for conditions not met by centrifugal pumps, and where comparatively smooth discharge flow and highest mechanical and volumetric efficiencies are required, are claimed to be particularly well adapted. A very large range of these pumps is illustrated and described. Those interested should apply to the Worthington Pump & Machinery Corporation at Harrison, New Jersey, or to any of their accredited agents.

Oliver United Filters.—Bulletin No. 202, describing the Oliver-Campbell Cachaza Filter in cane sugar mills, has lately been issued by Oliver-United Filters Inc., of Hazleton, Pa., U.S.A. This is an efficient continuous filter for recovering the juices drawn off with the solid impurities which have settled to the bottoms of the juice clarifying tanks. The word " cachaza " has been used, because it is the name for settlings from hot defecated cane juice in Cuba, where this type of filter was developed. This filter claims not only to simplify the process of making sugar but materially to reduce the cost. Its action is continuous and automatic, for the slowly revolving drum automatically picks up a coating of solid impurities on its external surface, extracts the sucrose therefrom, removes the surplus moisture and then discharges it in cake form very suitable for application to the fields as a fertilizer. These filters have already been successfully tried out in Cuba, Brazil and the Philippines.

Sugar in Pernambuco.

(From a Correspondent.)

The sugar industry in Pernambuco has passed through two years, and is well into the third, of unprecedentedly low prices, a depression mainly caused by official interference, itself originated by want of coherence and class spirit among the producers, who are mostly more anxious to serve the interests of their political party than those of their industry.

Two years earlier, more or less, a " Bourse " or produce market for selling produce by auction had been started, which degenerated into an institute for gambling in futures, parcels changing hands as many as eight times before shipment to the southern market. To allow of a margin for everybody in the game, prices to the producer naturally had to begin at bedrock and the producers became alarmed. To stop this speculation it was necessary to form a " Convention " of producers ; and to force all the factory owners to come in certain measures affecting export had to be taken, which only with the help of the State Government could be enforced. Unfortunately, the beneficial support of the State did not confine itself to these measures, but Palace interests were involved in the appointment of the management of the business as sole receiver and seller, and those appointed were conspicuous by their want of experience of the sugar market, with the result that fair prices were rejected and large stocks help up in Pernambuco, whilst the other States, backing out of their agreements, sold freely, leaving this state with large surpluses at the end of the last two crops (which eventually had to be liquidated under disastrous conditions) as well as bearing the brunt of the considerable amount sent to Europe at the very low prices in that market. Further, the surplus of last crop was got rid of to refiners in the south under the condition that further shipments of the new crop were to be held up till October, with the natural result that low prices have again ruled up to now, the lowest ever recorded in Pernambuco (taking the sterling value, about 5s. the cwt. at November 28th for "plantation white" quality of crystals).

Money was scarce to hold sugar before the revolution of October 4-24th and naturally prices are not likely to improve greatly till complete confidence is restored and there is a return to normal conditions so that assistance comes along to hold stocks in the face of a certain shortage of the present crop,- a probable 40 to 50 per cent. reduction on the last in Pernambuco, which passed 300,000 tons.

Several centrals were due to close in January ; those that could hang on into February hoped to get a better price. Drought and short money have both contributed to the diminished amount of cane, though there has been some compensation in the better quality of the juice in many usines.

With such prospects, the sales of machinery, very active 18 months ago, are at a standstill and likely to remain so for another 12 months at least. As elsewhere the high prices of recent years increased the number and capacities of factories and the consequent production of sugar, and the only remedy is to get production and consumption level again. The "coffee crash " in Sao Paulo and Rio has no doubt held up consumption to a great extent, and has added to the general low state of industry and commerce, sucked dry by over-taxation the proceeds of which were grossly misapplied. The late revolution had been brewing for over ten years, and, when all constitutional government had been finally made an end of by the late government, it came to a head. There is ground for hoping that the new brooms will wear well and with a proper application of the really great resources of

the country general prosperity with improved consumption in its train may restore equilibrium and leave a margin of profits to start again the renovation of older plants with modern machinery.

The British West Indies.

Sugar Crops during the Year 1929.

In a Department of Overseas Trade publication lately issued dealing with "Economic Conditions in the British West Indies" the sugar crops of the various colonies for the year 1929 are summarized. We give below the principal features.

British Guiana.—The sugar crop for the year 1929 was 117,254 tons, as compared with an average of 100,414 tons for the preceding ten years. The area reaped was 56,126 acres, the average yield thus being 2·09 tons sugar per acre. The export of molasses amounted to 2,536,623 gallons and of molascuit cattle food 1803 tons. The area under cultivation has considerably decreased in recent years, nevertheless production has been steadily maintained and actually shows a noteworthy increase. As the principal variety cultivated remains the same, improvements in tillage and field management—in some cases extended practice of the water fallow system (keeping old cane fields under water for some months before planting)—would appear largely responsible for the increased yield of sugar per acre being obtained. In spite of low prices the general fact emerges that the status of the industry, based on the output, remains unimpaired, providing ample proof of the suitability of this industry to the Colony.

Trinidad.—The 1929 crop came to 89,926 tons of sugar, thereby constituting a record. The ratio was one ton of sugar to nine of cane, which is a good extraction for Trinidad. In the fields the use of power implements enabled land to be worked in the dry season which formerly had to remain untouched until such time as the rains made it possible for hand labour to commence operations.

Barbados.—The climatic conditions in Barbados throughout the growing season of the crop reaped in 1929 were less favourable than those for the record crop reaped in the previous year. They were, however, favourable for the production of juice with abnormally high sucrose content. No new sugar factories were erected, nor were there any notable enlargements to existing ones. A proportion of the crop was still reaped in the old-fashioned windmill factories for the manufacture of fancy molasses. Measures for the control of insect pests—the moth stalk borer and the root borer—were adopted during the year by the Dept. of Agriculture. A reasonable degree of success is already claimed in respect of the former pest, whereas no conclusion can be drawn in respect of the latter. Efforts to control mosaic continue to be successful. Unfortunately, however, gumming disease has gained admission to the island, being first detected in 1929. At present it exists only in a mild form, and it is believed that it can be definitely controlled.

Jamaica.—Sugar did better in 1929 than might have been expected, with an export record of 37,380 tons. Most estates covered expenses or made a small profit, due to improved yields of cane from the fields. The recent crisis in the sugar industry has been particularly unfortunate for Jamaica, because the planters have been making marked strides in the cultivation of improved canes, in deep tillage, irrigation, the use of lime and fertilizers, whereby greatly improved yields of cane have been obtained. Of new seedling canes BH 10 (12) is the most generally successful, while POJ 2725 and POJ 2878 are expected to prove of decided advantage to cane planters and are being distributed as rapidly as stocks permit.

Leeward Islands.—During the 1929 season agricultural conditions were bad in both Antigua and St. Kitts. In the former island, the export of grey crystals amounted to only 9700 tons as compared with 18,906 tons in 1928. Little muscovado was produced, only one factory turning this grade out. Antigua is particularly susceptible to crop fluctuations attributable almost entirely to variations in rainfall during the growing season. In St. Kitts-Nevis drought and a hurricane reduced the crop by 30 per cent. as compared with 1928, 13,723 tons of grey crystals being turned out from 120,364 tons of cane; the average of cane per acre was 17·3 tons.

Publications Received.

Massecuites, Molasses, and Sugar. A. L. Webre. 131 pages. In Spanish and English. (United States Pipe and Foundry Company, Burlington, New Jersey, U.S.A.). 1930. For free distribution.

Mr. Webre is well known as an expert on evaporation, and the author of a very valuable treatise on the subject; while the publishers are recognized as a reputable firm of builders of apparatus. Although this publication may be regarded as an advertisement of this firm, it is really more than this. The calculations necessary to economically control the operations of the boiling house are far from easy; and unless an ordered and controlled system is followed greater volumes of material than necessary may be handled in the pans or at the centrifugals. This small book gives an account of the distribution of the products which enter and leave the boiling-house. Its subject matter is presented in a clear and orderly manner, both the two and three massecuite systems being included; and the tabulated calculations are further exemplified by a number of graphs and coloured diagrams. In the calculations true as opposed to apparent purities are used, a procedure which adds to the value of the publication which may well be in the possession of anyone connected with the operation of a sugar-house.

N. D.

Verdampfen, Kondensieren und Kühlen. E. Hausbrand. Seventh Edition with Special Consideration of Evaporating Plant; completely revised by M. Hirsch; with 218 illustrations in the Text. (Julius Springer, Berlin). 1930. Price: RM. 29 (bound).

The late E. Hausbrand's work has long been regarded as a valuable one on the theoretical aspects of evaporation and condensation, its mathematical treatment of the subject being an especial feature. But this new edition by Hirsch is a complete revision, being planned on different lines. It is divided into two parts, the first dealing with purely scientific matters, and the second and longer part with the application of the principles previously elucidated. This second part deals with heat transmission, heat flows, heat balances, with efficiencies and losses. On its more practical side, it considers multiple effect evaporation, pre-heating, the evaporator as heat transformer, evaporation with vapour condensation, etc. Further, in this second part various types of apparatus are now described and illustrated, the special designs of prominent constructors being divided up into groups according to the type of heating system adopted. One can see, therefore, that this is essentially a new work on different lines compared with the old Hausbrand. It must be regarded in every way as an improvement. It is now better adapted to the use of heat technicians, besides being more clearly written, and possessing greater continuity throughout. It is an infrequent example of a noteworthy book being improved by its reviser; and it is hoped that an English version prepared from this "vollständig neu bearbeitet" edition will appear before very long.

Untersuchung und Bewertung Technischer Adsorptionsstoffe. By Dr. Ing. Franz Krczil. With 106 figures and 174 tables. (Akademische Verlagsgesellschaft m. b.H., Leipzig). 1930. Price: RM 30.

Adsorbents are understood to be charcoals and carbons, silicious earths, aluminous earths, and the like, which are now employed in increasing amount in a number of industries such as: vegetable and mineral oils, glycerin, fine chemicals, solvent recovery, and water purification. In its "General Part" this book compiles data on the chemical and physical properties of chars and earths; while its "Special Part" is given over to the consideration of individual industries. Decolorizing carbons are now in regular use in Czecho-slovakia, Germany and elsewhere in beet sugar refining; and have also been adopted in certain cane-growing countries for plantation sugar refining. It is suitable, therefore, that carbons should be given good attention in this book, the large amount of work done mostly on the Continent during recent years in connexion with their analysis, decolorizing power, *pH*, colloid adsorption power, filtrability, etc., being very faithfully recorded. The book can be well recommended. It is quite a welcome attention to the literature of adsorbents.

Industrial Microbiology : The Utilization of Bacteria, Yeasts and Moulds in Industrial Processes. By Henry F. Smyth and Walter L. Obold, Assistant Professor of Biological Sciences in the Drexel Institute. (Baillière Tindall & Cox, London). 1930. Price : 27s.

Microbiological processes are particularly in evidence in our industry, commencing with the time that the cane reaches the mill, and continuing until the sugar is in the store. Here is a book that reviews the technical aspects of the subject in a very complete manner. In it we find accounts of micro-biological processes which have been developed for the commercial production of certain chemicals, for example, citric acid from cane sugar, glucose, or molasses; and glycerin from molasses. Information is given bearing particularly on subjects of interest to the sugar technologist, as alcohol fermentation, the microflora of sugar, raw juice deterioration, bagasse fermentation, enzyme action, and the like, information likely to bear on various problems with which he may be confronted. It is well written, and gives a good general insight into a subject which has become of increasing importance during the last few years and promises future developments of great technical value.

Tables to be used with Sikes's "B" Hydrometer. Part I and II. (H.M. Stationery Office, London). 1930. Price : 1s. 6d.

Tables I and III for use with the ordinary Sikes's hydrometer and II and IV for use with the "A" hydrometer have already been published. The present volume contains Tables V and VI for use with the "B" hydrometer, that is where by reason of the high temperature or strength of spirits the determination cannot be carried out by the ordinary instrument, the so-called "B" hydrometer being required. Part I is for ascertaining the strength of spirits at temperatures ranging from 47 to 100°F.; and Part II for determining the weight per gallon. These tables are issued under the Authority of the Commissioners of H.M. Customs and Excise.

Viscometry. Guy Barr, B.A., D.Sc. Royal 8vo.; p. xiv + 318; with 54 figures in the text. (Oxford University Press, London; Humphrey Milford). 1931. Price : 30s.

This monograph by a writer who holds the post of a Senior Assistant, at the National Physical Laboratory, Teddington, contains some account of the more important methods used or suggested for measuring the viscosity of fluids. It discusses the sources of error which have to be considered in the design of viscometers for particular purposes and indicates the precautions which should be adopted in the practical use of the instruments. Half the book is devoted to capillary-tube methods. Of the more difficult mathematical problems, the premises and solutions only are quoted. A precise knowledge of the viscosity of syrups and molasses should be a matter of importance in the sugar factory, seeing that the results of filtration, and the processes of crystallization and centrifuging are each closely connected with this property. Much has yet to be learnt on the rôle played in sugar manufacture by the viscosity. This book will be of value to those who may require to carry out investigations in this direction.

Reports of the Progress of Applied Chemistry. Volume XV, 1830. (Society of Chemical Industry, London). 1931. Price : 7s. 6d. to Members; and 12s. 6d. to others.

We are pleased again to notice the publication of these Annual Reports on progress made in different branches of chemical industry. "Sugars, Starches and Gums" is well reviewed by Messrs. L. EYNON and J. H. LANE. "Soils and Fertilizers" is again dealt with by Dr. E. M. CROWTHER, of the Rothamsted Experiment Station; and this year the account of "General Plant, and Machinery" has been written by Mr. R. Edgeworth-Johnstone. These annual reports provide a valuable means of keeping abreast of the progress made in the industry in which one is interested and in those which are allied.

Brevities.

Canadian Sugar Merger.—An amalgamation has been effected between the Canada Sugar Refining Co., Ltd., of Montreal, founded in 1854, and the Dominion Sugar Co., Ltd., of Chatham, Ontario, which was founded in 1901. The new company will be known as the Canada and Dominion Sugar Co., Ltd, and its headquarters will be at Chatham.

Juice Weighing.—At the First Annual Conference of the Queensland Society of Sugar Technologists, Mr. Norman Bennett, Technologist, Experiment Station, Mackay, said that in Java the Maxwell-Boulogne scale is considered the most accurate and dependable. Now that the original defect concerning the knife-edges has been removed almost every mill is installing them for weighing thin-juices, maceration water, molasses and muds.

Drawbacks on Sugar in Canary Islands.—A recent Government Order in the Canary Islands provides for the refund to manufacturers of the tax paid on imported sugar used in the preparation of chocolates, sweetmeats, jams, jellies, syrups, etc., exported to foreign countries or to the Spanish Zone of Morocco. The refund will be made at the rate of 30 pesetas per 100 kilos. net. of the exported product where the sugar content exceeds 40 per cent. of crystallizable sugar, and at the rate of 10 pesetas in other cases.

Evaporator Tubes.—In some cases trouble has been experienced in sugar factories from the use of evaporator tubes of ordinary qualities, due to their splitting at the ends, to dezincification, and to "season cracking." A prominent British manufacturing firm now advocates the use for this purpose of evaporator tubes made of special alloys, such as aluminium bronze. Costing very little more than copper, such material is said not to be liable to the defects noted above, besides being definitely resistant to corrosion by weak alkalis or acids.

Industrial Uses for Sugar.—The Mellon Institute of the University of Pittsburgh has lately begun a broad investigation into the possible industrial uses for raw and refined sugar. The research will be carried on by a Multiple Industrial Fellowship that will be sustained by the Sugar Institute, Inc., of New York, the organization that represents the cane sugar refiners of the United States. In the view of the Institute authorities, various studies made by private research workers have already indicated results of industrial promise. Most of these relate to applications for sugar in such technologic practices as wood preservation, textile finishing, and the manufacture of adhesives. In any case sugar is thought to merit searching investigation as a basic raw material for employment in various branches of chemical industry.

Formosan Sugar Production.—The Acting British Consul at Tamsui reports to the Department of Overseas Trade that the second official forecast of sugar production for the 1930-31 season in Formosa has just been published. The output of centrifugals (including plantation white) is placed at 13,072,840 piculs (about 771,951 tons) and that of brown sugar at 161,051 piculs (9510 tons) making a total of 13,233,891 piculs or 781,461 tons, as compared with 13,508,051 piculs in 1929-30. The above estimate has been based on the actual condition of the cane fields at the end of October, in conjunction with subsequent observation. When compared with the high record season of 1929-30, the estimated decrease amounts to 274,160 piculs or 15,008 tons. This is to be ascribed to the decrease of some 27,000 acres which has taken place in the area planted.

Ammonia Clarification.[1]—R. H. King, of the College of Agriculture, Philippines, raises the possibility of using ammonia in place of lime for the clarification of cane sugar juices. " Synthetic ammonia, the base of most nitrogen fertilizers, can now be purchased at the lowest price in history, and the future promises even lower prices. This means that the nitrogen-deficient soils in these Islands can be made productive at a slight cost. It also means that a cheap source of alkali for sugar-house clarification is within sight. With the advent of highly compressed ammonia the clarification station will use liquid ammonia in large cylinders, and alkalinities will not result in the introduction of a large amount of lime salts." It would surely be useful to conduct experiments on ammonia clarification to show its advantages and its possible defects, though it seems likely that its cost, delivered factory, would very much exceed that of local lime, due to transport charges to and from factory on the containing cylinders.

[1] *Sugar News*, 1931, **12**, No. 1, 60-61.

KOPKE CRYSTALLIZER.—Results obtained in raw sugar factories in Cuba, Porto Rico and elsewhere, and in refineries in the U.S. are claimed to have shown: a reduction from 80 to 30 hours in cooling time; a reduction of 3½ points lower purity of final molasses; a reduction of re-circulation of low-grade molasses; increase of 30 per cent. capacity in low-grade centrifugals; and total abstinence of foaming.

MR. W. E. DESPLACE.—This gentleman who has held important positions in factories in Australia and Mauritius and was for a time general factory manager of four factories of the Sena Sugar Estates, Ltd., announces that he is prepared to report and advise on the modernizing of sugar factories with a view to labour economy and greater efficiency. He has specialized in the manufacture of high-grade plantation white sugar. Address: Gingindhlovu Post Office, South Africa.

CELOTEX CO.—The net income of the Celotex Co. for the year ended October 31, 1930 was $244,079 after depreciation, interest, and federal taxes, equal to $4·58 a share on 53,266 shares of 7 per cent. preferred stock. This compares with a net income in the preceding fiscal year of $1,478,590, equivalent after preferred dividends to $6·14 a share on 181,403 average common shares outstanding during that year, and $5·42 a share on 205,194 common shares at the end of the year.

QUEENSLAND SUGAR PRODUCTION IN 1930.—According to figures supplied by the Registrar-General of Queensland, the estimated quantity of sugar turned out in that State during 1930 was 512,657 tons of 94 net titre, which compares with 518,516 tons in 1929 and 520,620 tons in 1928, the last being a record for Queensland. Thirty-seven mills were in operation during the year and 230,567 acres of cane were cut for crushing, yielding some 3,507,827 tons of cane. All the above figures are however subject to final revision.

ADHESIVE FROM BEET PULP.—V. V. Yuanovski states that a glue can be prepared from beet pulp, the adhesive quality of which is superior to that of the best joiner's glue. Pectic acid is probably the important constituent. Fresh or steam-dried pulp is boiled with hydrochloric or sulphuric acid at a concentration of 3 per cent. on the dry substance present until the refractive index of the extract is constant, strained through cloth, evaporated *in vacuo*, and finally dried in thin layers on a glass plate at room temperature or in a dryer at 40°C.[1]

"THERMOFIX."—This is a material of great fire-resisting properties for repairing the fireclay brickwork of furnaces and kilns. It is being used in Java, where it is found to effect distinct economies in the patching of the deteriorated brickwork of bagasse furnaces, as well as for the lime-kilns here. In applying it, the damaged portions are freed from ash and clinker, thoroughly wetted, and the "Thermofix" put on in thin layers until the broken-down part has been repaired. Suspension arches can generally thus be restored, and made to last for a considerable time longer.

OBITUARY NOTE.—We regret to announce the death of the Hon. D. d'Emmerez de Charmoy, I.S.O., Director of Agriculture, Mauritius, who succeeded Dr. Tempany in 1928 as head of the Department of Agriculture of that Colony. He was the author of a number of valuable papers on the subject in which he specialized, these bearing on the diseases and pests of the cane, on anti-malarial measures, insects attacking grain, the deterioration of white sugar,[2] etc. He had a considerable reputation as an entomologist; and was highly regarded as an administrator in Mauritius. An unassuming and indefatigable worker, his loss will be deeply felt by that community.

ALCOHOL FORM MOLASSES IN CUBA.—According to the *Cuba Review*, Sr. VASQUEZ BELLO, President to the Cuban Senate, is working hard to bring about an agreement among the sugar mill owners of Cuba by which a large part of their waste molasses mey be used for conversion into industrial alcohol to be employed as the principal fuel for motor vans and trucks in the island. Alcohol from molasses (mixed with a small percentage of ether) has already been shown in Cuba to be a very satisfactory fuel for the propulsion of nearly all classes of mechanical vehicles, and the economic advantages of using a locally produced fuel are too manifest not to be exploited. The big oil companies will probably oppose any such plan, but a heavy import tariff placed on oil would counteract efforts from that source.

1 *Facts about Sugar*, 1931, 26, No. 2, 75. 2 *I. S. J.*, 1922, 454, 527.

Review of Current Technical Literature.[1]

Boiling in American Refinery Practice. **H. A. Ditmar Janssen.** *Archief* 1930, **38**, No. 16, 362-370.

In this article are described the vacuum pan and the method of boiling introduced recently into the Edgewater plant, of the National S.R.Co., U.S.A., considered to be an improvement in this already well-operated sugar-house, in so far as the quality of the sugars is concerned, as well as regards pan and centrifugal capacity. Its contents are 500 hl. (about 11,000 Imperial gallons); its heating surface of 125 sq. m. (about 1350 sq. ft.) is divided into six superimposed coils having the same inclination plus a bottom coil (the 7th which appears in the drawing not being used). A top view is shewn of a complete coil, which consists of three short pieces, each having a a separate steam valve outside the pan and a steam-trap. In this way one realizes the same result as with other pans with short coils, though without the interior control box, which is a hindrance for good circulation, and besides gives rise to incrustation and caramel formation in the pan. The pan has a diam. of 14 ft.; the greatest distance between coil and wall is 12 in.; and the working space has a section of 3 ft. Also between the windings of the coils there is plenty of space. All the pans in the refinery have a separate barometric condenser and air-pump, the injection water pump being central, and the pressure in the line about an atmosphere. The juice-catcher placed outside the pan is the sole protection against entrainment; but it is entirely adequate, even though one boils up to the top sight-glasses. Its principle part consists of three series of copper tubes, which are placed obliquely behind each other so that they form a baffle perpendicular to the direction of the steam. By means of cooling water, this baffle of pipes is kept at 10° below the normal temperature of the contents of the pan, that is about 70°C. The condensate goes to the sweet-water tanks by way of a vacuum trap.

The valve admitting the "juice" is half-way up the conical bottom, a suitable position, and besides this 6 in. pipe there is a 3 in. pipe, laid on for continuous juice admittance. Inside the pan there are no pipes of saw-section or otherwise, though juice distribution presents no difficulty. The juice distributing box stands free of the pan, suitably situated for the boiler. The bottom valve has a diam. of 2 ft., and the cuite gutters are so dimensioned that the pan can be rapidly discharged. Opposite one another, and at different heights, there are two steaming out pipes for fresh steam, besides which inside the pan at the top there are placed two specially designed sprayers, which spray hot water over the coils at a pressure of about 1·5 atmos. for a few seconds during steaming out. Very little water is required for this. Besides the mercury vacuum gauge, the following accessories are noticeable: a registering thermometer, a well-constructed cock for drawing in seed, an electric heating lamp above the proof-stick, sprayers for the sight-glasses, and a copper wash-basin with hot and cold water under the stick.

Only one kind of steam is used at the boiling station, namely a mixture of exhaust and live at 3 atmos., which pressure remains the same even when all valves are full opened. In the pan under description the same syrup of 96-97° purity from previously obtained high purity massecuite is always boiled. It crystallizes out easier than does Java carbonatation evaporator syrup of 90° purity, and easily gives a hard grain. Boiling is controlled entirely by a thermometer placed between the 2nd and 3rd coils, and the injection valve *A*, operated by a chain-wheel.

Conductometric Determination of Ash: (*A*) in Both Raw and Refinery Syrups and Molasses. **Louis Sattler and F. W. Zerban.** *Ind. & Eng. Chem.*, 1931, 3, No. 1, 38-40. (*B*) In Refined Cane Sugar. **F. W. Zerban and Louis Sattler.** *Ind. & Eng. Chem.*, 1931, 3, No. 1, 40-43.

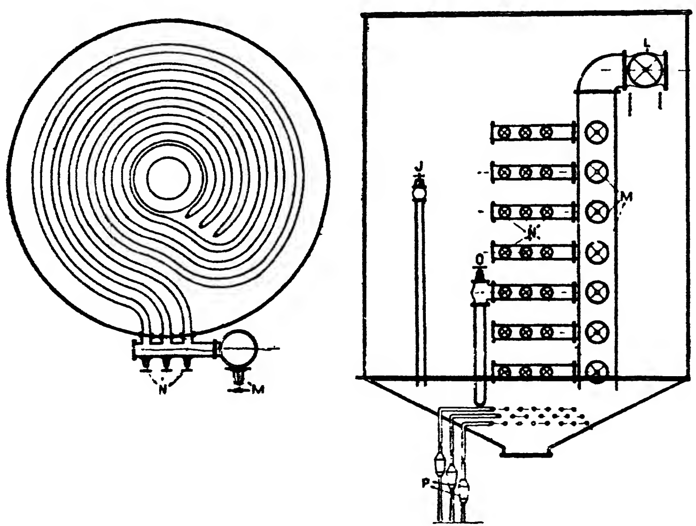
(*A*) In previous papers[2] the writers have pointed out that where the origin of the sugar was unknown the simple conductance method (specific conductance of the solution containing 5 grms. of raw sugar in 100 ml. × by the specific *C*-ratio of the particular community) was inadequate, and it was shown that the equation: Ash = $0{\cdot}001757\,(0{\cdot}913K + 193{\cdot}5 - 0{\cdot}1K_1)$ gave good results regardless of the source of the

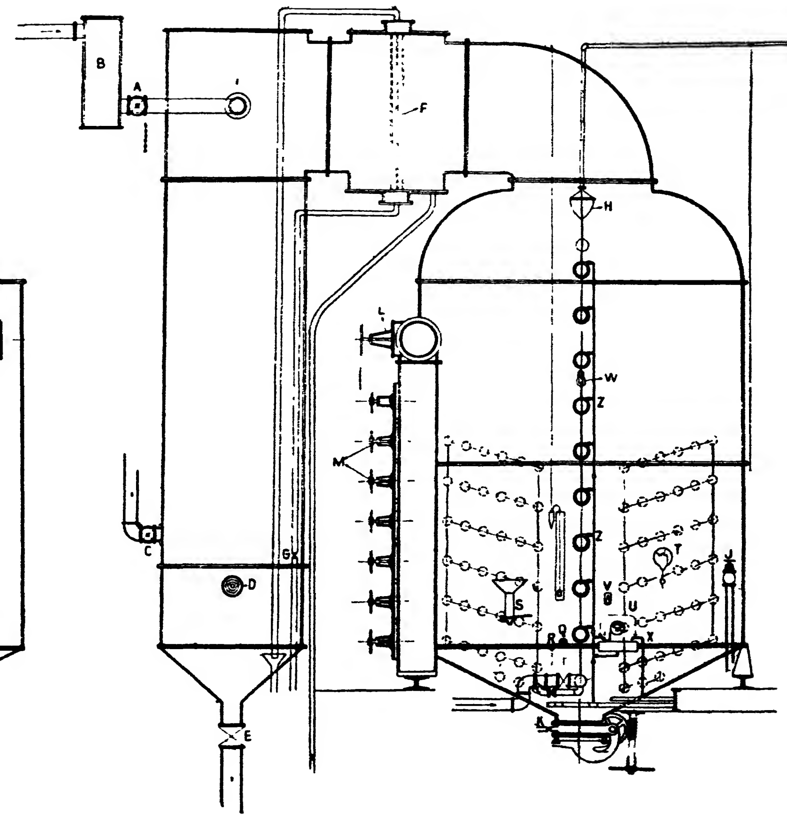
[1] This Review is copyright, and no part of it may be reproduced without permission.—Editors *I.S.J.*

[2] *I.S.J.*, 1928, 31; 1929, 324; 1930, 155, 313, 589.

EDGEWARE REFINERY VACUUM PAN.

A, injection valve; B, sand-catcher injection water; C, valve on the inlet line from the air pump; D, air-inlet damper and fall-water valve; F, cooling tubes of the juice-catcher; G, valve on the juice-catcher discharge line; H, sprayer; I, valve for the sprayer; J, steaming-out valve; K, outlet for steamings; L, main steam valve; M, M, M, main coil valves; N, individual coil valves; O, valve for lower steam valve; P, steam-traps; Q, hand-wheel for 6 in. inlet line; R, ditto for the 4 in.; S, valve for taking in seed; T, thermograph; U, proof-stick; V, heating lamp; W, light for the sight-glasses; X, cold water; IJ, hot water, Z, sight-glass washers.





sugar, K being the simple conductance $\times 10^6$, and K_1 the specific conductance $\times 10^6$ of a solution made by taking 200 ml. of a sugar solution (5 grms. per 100 ml.) and adding to it 5 ml. of 0·25 N-HCl. This formula 1 method was found to hold for syrups and molasses produced in the raw cane factory, but did not give good results for refinery syrups, the factor varying from refinery to refinery. Later, formula 2 was developed, in which ash $= 0{\cdot}01757\,(1{\cdot}33K + 498{\cdot}3 - 0{\cdot}091K_1 - 0{\cdot}5K_2)$, in which K and K_1 are the specific conductances $\times 10^6$ without and with 0·25 N-HCl and K_2 the specific conductance $\times 10^6$ with 0·25 N-KOH. Although it gave excellent results with refinery products, it was exceedingly poor for Porto Rican blackstraps. Hence yet another (No. 3) formula was developed, namely ash $= 0{\cdot}0191369K - 0{\cdot}002249K_2 - 0{\cdot}001210K_3 + 3{\cdot}07$, K being the specific conductance of the solution, K_2 that of a solution made by taking 200 ml. of sugar solution and adding to it 5 ml. of 0·25 N-KOH, and K_3 that of a similar solution but adding this time 5 ml. of normal orthophosphoric acid, each of these three values being $\times 10^6$. This No. 3 formula (for which a nomograph is given) shows general applicability for various types of raw cane as well as refinery products, including thus Cuban and Porto Rican blackstraps as well as refinery syrups and molasses. A beet molasses also fell into line. This new method therefore eliminates the former conductometric distinction between raw and refined products. Not only that, but in every case it is superior to the C-ratio method where the individual idiosyncrasies of the products were taken into consideration.

(B) In this paper, refined cane sugars are examined. It is pointed out that the ash per cent. in granulated and remelts containing less than 0·3 per cent. of ash can be found by dissolving 25 grms. of the sample in 100 ml. of conductivity water, determining the specific conductance of the solution at 20°C., and multiplying the result (after correcting for the conductivity of the water) by the factor 530. For soft sugars, only 5 grms. are taken, the appropriate factor (which varies from place to place) being determined for each refinery, or else the general method described above using formula (3) may be employed. Summarizing their recommendations, the authors say that it is desirable and quite possible to use the ordinary C-ratio procedure with only one conductivity determination, based on actual comparisons of chemical ash and specific conductance of the various products. These should include not only the materials studied by the writers, but should be extended to several types of juices. When samples are received from many different sources, such as in regulatory and similar work, the choice of the proper method will depend on the type of product analysed. For granulated and other refined sugars of low ash content the simple C-ratio method outlined in this paper is sufficiently accurate. For raw cane sugars and soft sugars, the simple conductometric formula with two conductivity determinations should be used, the factor being 0·001757 for raw sugars and 0·001695 for soft sugars. The same method with the factor 0·01757 will also suffice for syrups and molasses known to have been produced without char treatment, but otherwise it is safest to resort to the general conductometric formula as given above based on three conductivity determinations, one of the solution itself, one with the addition of phosphoric acid, and one with the addition of KOH, using formula (3).

Working Three Massecuites in Mauritius. **A. Hardy.** *La Revue Agricole*, 1930, No. 50, 56-57.

Following is the scheme of fabrication which has been used by the writer in making raws in Mauritius, 94·7 per cent. of his production being in this grade, the remainder being whites at the beginning of the campaign : Juice from the mills was submitted to the usual sulpho-defecation process, that is to say, sulphited to 0·5 grm. of SO_2 per litre and neutralized with milk-of-lime to a pH of 7·0 to 7·1. Syrup leaving the evaporators had a density of 25-27°Bé. with an average purity of 87·3° which made it necessary towards the middle of the crop to return run-offs to the first massecuite to keep its purity at 85° Clerget purity. A first massecuite (massecuite-A) was made from the syrup, adding a little run-off at the end of boiling if the purity of the syrup was above 85° Clerget purity. This massecuite-A was cooled in a Lafeuille crystallizer during 3 hours and meantime fed with poor run-offs from a previous

massecuite-*A*, these being diluted and re-heated. Next it was centrifuged in the finishers, the run-offs and steam washings not being separated, and the mixture of the two giving a Clerget purity of 64°. These run-offs were diluted and re-heated to a temperature never exceeding 50°C. and afterwards sent to the pans over a *pied-de-cuite* of massecuite-*A* in the proportion of 1/3 of the cuite and 2/3 of run-offs, this giving the second massecuite or massecuite-*B* at a Clerget purity of 70.°

This massecuite-*B* was malaxed in ordinary crystallizers while feeding re-heated and diluted run-offs from former second massecuites, this lasting 30 hours. It also was turbined in finishers, the run-offs and steam washings giving a molasses of 51° Clerget purity. This last-mentioned molasses was diluted and re-heated to a temperature not exceeding 50°C., and sent to the pans over a *pied-de-cuite* of massecuite-*A* thus giving a third massecuite, or massecuite-*C*, having a Clerget purity of 60°. This was run into ordinary crystallizers and malaxed during 48 hours while feeding in diluted and re-heated molasses; and after it had cooled it was turbined in first centrifugals giving exhausted molasses at 39·5° Clerget purity, and a sugar which was mixed with massecuite-*A*, raw sugar having an average polarization of 98·3 being thus made. It is said that Lafeuille crystallizers were found advantageous in the sense that they allowed one to turbine part of the cooled massecuite shortly after dropping with a maximum exhaustion and less run-offs to re-boil. Massecuite-*A* amounted to 50 per cent., *B* to 30, and *C* to 20 per cent. of the whole; and the average quantity of raw sugar extracted per 100 cane was 11·73 for the crop.

THE "CONICK" PIPETTE (PATENTED). *Communicated by the Inventor.* A pipette claimed to be more reliable and easier to manipulate than any existing design, and therefore particularly suitable for use in the hands of untrained assistants, is made in two parts. The lower is the pipette proper, and is made to contain accurately the volume which the instrument is to deliver; while the upper part (the safety-tube) is used for sucking up the liquid, and fits into the pipette proper by means of a finely ground taper socket, as shown. To operate the instrument, the pipette and safety-tube are connected, the end of the safety-tube put into the mouth; liquid is sucked up until the safety-bulb is reached; the tap is turned off; and the safety-tube withdrawn from the pipette proper. Then the liquid filling the pipette proper is delivered instantly and exactly without further manipulation. The pipettes are made to deliver 10, 15, 20 and 50 c.c., and the same safety-tube can be used for the four capacities. Three of these pipettes were selected from stock and sent to the National Physical Laboratory for examination, the Certificate returned stating that each was well within the Class A tolerence.—NEW AMERICAN DENATURANTS FOR ALCOHOL. **Anon.** *Chemicals*, 1931, No. 1, 16. All agencies of the Bureau of Industrial Alcohol of the U.S. were officially notified to discontinue on January 1st and after the use of wood alcohol for the denaturing of alcohol used industrially (including motor spirit), substituting the following formula: To every 100 parts by volume of ethyl alcohol of not less than 160 degrees proof add one part by volume of the compound or one similar thereto known as "aldehol," grade A, or 1·25 parts by volume of the compound, or one similar thereto, known as "alcotate." The authorities do not state that these new denaturants cannot be eliminated by re-distillation, though they count on the cost of this operation to make recovery too expensive for the average bootlegger. Both aldehol and alcotate are obtained from crude petroleum; the first is an oxidized kerosene, while the second is a by-product of Californian gasoline. They both have a "horrible smell and taste"; and an official of the prohibition service stated that "neither will kill you, but it will make you sick." Aldehol is highly soluble in alcohol and water; and does not easily respond to re-distillation or "cracking" processes through which other denaturants as essential oils may be removed.

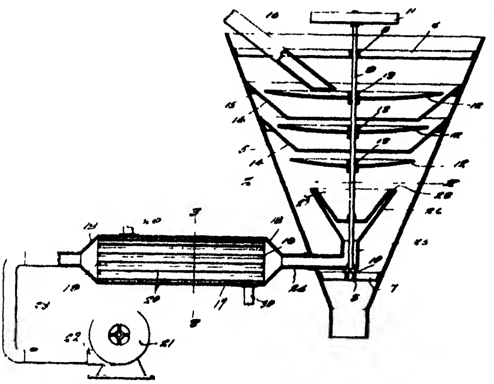
J. P. O.

Review of Recent Patents.[1]

UNITED STATES.

SUGAR DRYER. **David K. Richards**, of Hilo, T.H. 1,782,177. November 18th, 1930.

Apparatus for drying granulated raw sugar is described, the principal object of which is so to agitate it as to reduce the lumps to fine particles, and to apply heated air while the material is in motion. Referring to the drawing, the invention includes an inverted conical-shaped hopper 5, having spiders 6 and 7 in its upper and lower ends respectively for supporting the bearings 8 through which the vertically disposed shaft 9 is journalled. The lower end of the shaft is provided with a thrust collar 10 while the upper end thereof has a belt pulley 11 suitably secured thereto. A plurality of concavo-convexo shaped discs 12 are secured to the shaft 9 by their hubs 13. Each overlying disc is slightly greater in diam. than its adjacent under-lying disc in proportion to the increase in diam. of the conical hopper 5. Associated with the two lowermost discs 12 are the frusto-conical baffles 14, which baffles are provided with obliquely circumferentially extending flanges 15 whereby the same may be secured to the hopper 5 in a position so that the lower constricted ends are disposed over the corresponding discs 12.



Numeral 16 denotes a spout leading from a sugar supply source and terminating at its lower end immediately above the central portion of the uppermost disc 12. A drum 17 serves as a boiler with its ends constricted as at 18. Inwardly of the ends of the boiler are the heads 19 to which the ends of the air tubes 20 are secured. A blower 21 of suitable design has its outlet 22 connected to a pipe 23 leading to one end of the drum 17. The opposite end of the drum has a pipe extension 24 which leads through the lower portion of the hopper 5 and is disposed upwardly therein as at 25 in concentric relation with respect to the shaft 9. This upwardly extending portion 25 connected to a funnel-shaped head 26 within which a frusto-conical wall 27 is mounted, is of such dimension at its enlarged end as to provide a constricted fissure 28 of annular extent from which air may issue after having passed through the drum 17. Steam or some other heating agent may be delivered to the drum 17 through the inlet 29 and after passing through the drum may exist through the outlet 30. In passing through the drum, and around the air tubes 20, air passing from the blower 21 and through the tubes 20 will become heated and will issue from the constricted fissure 28 within the hopper 5. By reason of the specific construction of the head 26 and the disposition of the frusto-conical shell 27, the heated air will be directed toward the periphery of the lowermost disc 12. As the sugar is deposited from the spout 16, the same will fall on to the uppermost disc 12 and by centrifugal force will fall against the adjacent baffle 14. The sugar will then slide down the baffle 14 on to the next underlying disc 12 where the foregoing operation will be repeated. As the sugar leaves the lowermost disc by centrifugal force, the heated air will filter through the falling sugar so as to thoroughly heat and absorb moisture and air therein.

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

FILTER-CAKE DISCHARGER FOR A ROTARY FILTER. **Joseph V. Zenthoefer** (assignor to **Oliver United Filters, Inc.**, of San Francisco). 1,785,237. December 16th, 1930. Claim is made for stripping a filter cake from a filter screen comprises a rotating longitudinally grooved member, U-shaped wiping members secured in said grooves with the legs of the U extending outward from the body member.—CRYSTALLIZING SUGAR IN MULTIPLE EFFECT. **Joshua R. Ray and Thomas Ray**, of Manistee, Mich. 1,785,530. December 16th, 1930. A method of crystallizing sugar in multiple effect comprises partially filling an evaporating pan with liquor, evaporating a grain, slowly feeding more of said liquor to said evaporating pan, making a cut strike into a plurality of associated evaporating pans of said multiple effect, and then feeding the second mentioned pans with fresh liquor.—CANE CUTTER. **William H. Morgan** (assignor to **The Morgan Hurrycane Co.**, of New York). 1,785,743. December 23rd, 1930. In a stalk cutter, the combination of a frame, a hopper on said frame, stalk cutting apparatus within said hopper, means for delivering the stalks to the cutter, a rear-end conveyor, a trash guiding device at the rear of the rear-end of said conveyor and a blower adapted to discharge an air blast between the discharge end of the rear conveyor and the trash guiding device.—PRODUCTION OF FIBRES FOR WALL-BOARD. **Treadway B. Munroe** (assignor to **The Celotex Co.**, of Chicago, Ill.). 1,785,840. December 23rd, 1930. The process of preparing fibres for wall-board pulp which consists in subjecting the raw fibrous material to a cooking action in the presence of a suitable chemical produced from previous cooks and at a temperature and for a time sufficient to loosen the encrusting casing material of said fibres but insufficient to produce fibres suitable for paper making ; freeing the fibres from their cementing tissues and said casing by hydraulic action under force ; and recovering the fibres thus produced.—HANDLING BEETS. **Leonard B. Neighbour and Fredr. A. Thomann** (assignors to **Deerre & Co.**, of Moline, Ill.). 1,787,161. December 30th, 1930. An apparatus for separating dirt from beets and like articles, comprising in combination a horizontally elongated receptacle adapted to contain the articles in mass, means underlying and forming a horizontally elongated bottom for said receptacle which supports the articles therein in mass while permitting matter separated from such articles to pass therethrough, means under said receptacle for removing the separated material, and means for moving the lowermost of such articles longitudinally of said receptacle substantially horizontally under and relatively to the mass of overlying articles, and out of the receptacle.—MOLASSES FEED MIXER. **David E. Skirvin** (assignor to **Thos. J. Skirvin**, of Eugene, Oreg.). (*A*) 1,788,344. (*B*) 1,788,345. January 6th, 1931. (*A*) A mixing device of the character stated comprising a tank, a shaft extending longitudinally through the tank and having means whereby it may be rotated at a high speed, means for conducting molasses to a point contiguous to the shaft and discharging molasses upon this shaft to thereby cause the shaft to throw the molasses outward in the form of a spray, and means exterior of the point of discharge of the molasses upon the shaft for discharging the material to be mixed with said molasses from one end of the tank toward the other end of the tank through said spray. (*B*) A feed mixer and molassizer comprising a hopper, horizontally disposed rotatable spaced discs disposed in the upper portion of said hopper, the uppermost disc being annular, means for rotating said discs at a high speed, means for discharging syrup through the central opening of the annular disc on to the lower disc whereby the syrup will be discharged outward by centrifugal force in the form of a spray, a vertically disposed elevator mounted in the hopper and extending into the lower portion thereof and extending upward to the top of the hopper, a conveyor into which said elevator discharges, said conveyor discharging the grain into the hopper above said rotating discs whereby the grain in passing downward into the hopper will pass through the spray of syrup.—TREATING SUGAR SOLUTIONS. **Holger de Fine Olivarius** (assignor to the **California Packing Co.**, of San Francisco). 1,788,628. January 13th, 1931. In a process of recovering sucrose from impure sugar solutions containing invert sugar, the steps of bringing the impure sugar solution to a concentration of between 35 and 65° Brix so as to allow subsequent fermentation of invert sugar to take place without material inversion of sucrose, and then fermenting said impure sugar solution with the aid of special selectively fermenting yeasts,

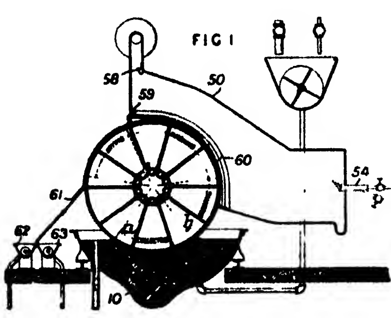
UNITED KINGDOM.

Production, Revivification, and Application of Activated (Decolorizing) Carbon. (*A*) **Metallges. Akt.-Ges.,** of Frankfort-on-Main, Germany. 338,500. May 15th, 1929. (*B*) **E. M. Salerni and E. M. S. Industrial Processes, Ltd.,** of London. 338,939. July 30th, 1929.

(*A*) In the process of re-activating carbon in lump form the pieces of carbon are disposed in a compact mass without intermingling movement in a container, e.g. the adsorber, part or the whole being preheated, and are then treated with gas or gas and vapour mixtures having a content of less than 8 per cent. of oxygen, the preheating being then discontinued and the heating gas supplied at a temperature not substantially greater than 250°C., and preferably below 200°C., whereby a localized re-activation zone is formed which travels in the direction of flow of the gaseous medium. The mass of carbon may be moved through the reaction vessel, without relative disturbance of its parts, at a rate corresponding to the progress there-through of the zone of reaction. (*B*) In the heat treatment of carbonaceous and other materials, the materials during their continuous passage through a chamber or retort in one direction are subjected to a secondary movement in a direction opposed to the general flow of the material " en masse " through the apparatus. The means employed to effect this movement are wholly submerged in the material.

Curing Massecuite with a Rotary Filter. **W. W. Triggs** (communicated by **International Patents Development Co.,** of New York). 339,015. September 16th, 1929.

This invention consists in a method of purging a massecuite of its mother-liquor by means of a rotary vacuum filter according to which the crystals, which are collected on the perforate wall of the filter and thereon drained of mother-liquor, are washed by a dispersed water mist which is moved to and through such crystals. It also consists in a rotary vacuum filter for use in the method set forth in the preceding paragraph, having a housing which encloses the portion of the filter surface through which the dispersed water mist is drawn, and in which the dispersed water mist is produced by the injection of water with compressed air through an atomizing nozzle located in the housing at a substantial distance from said filter wall. It relates to the treatment of crystal massecuites, more particularly dextrose or grape sugar massecuites. Referring to the drawing, the crystals are collected on the perforate wall of the filter and washed by dispersed water mist. The massecuite is collected from the vessel 10 on the portion *a-b* of the drum, drained as it leaves the vessel and is washed by a dispersed water mist from an atomizer 54 in a housing 50. The crystals are dried after passing out of the housing. A lower vacuum is used for collecting the crystals and drying them than for draining and washing. A scraper 61 delivers the crystals to conveyors 62, 63. Gutters 58, 59 and 60 prevent the condensate dripping upon the material on the drum.



Sugar Liquor Filters. A. R. Jahn. 334,663. July 17th, 1929. Apparatus for filtering sugar solutions, oils, or other liquids under pressure, comprising a closed casing divided by partitions into spaces, which are filled with charcoal, sawdust, sand, kieselguhr, or other filtering-medium and through which the liquid passes successively in a serpentine path is provided with a collecting vessel for the filtered liquid having an upstanding outlet. The filtering medium may be revivified *in situ* by successive treatments with acid, alkali and superheated steam.—Filters. J. A. Pickard and F. Rogers. 334,569. May 7th, 1929. The elements of an edge filter are formed as

discs with central apertures and isolated spacing protuberances pressed up on both faces of the element. Elements are preferably arranged to alternate with plain discs, and they may be tapered outwards. They may also be saucer-shaped.—FERMENTATION PROCESS. **Darco Sales Corporation,** New York. 335,972. July 3rd, 1929. In fermentation processes in which active carbon is present as described in Specification 336,207 the micro-organisms and active carbon are first added, preferably intimately associated, to a solution of medium density of the material to be fermented, whereafter, the density having been reduced by fermentation, it is increased above the initial density by the addition of a solution of high density of the material to be fermented. Thus, yeast and active carbon are added initially to a solution of 20° Brix, fermentation is carried out till the density falls to 12° Brix, a concentrated molasses solution is then added until the density is raised to 27-30° Brix, the fermentation being then continued. The activated carbon used may be that sold under the name "Darco" produced from lignite.—DRYER (FOR BEET SLICES, ETC.). **B. J. Owen and R. O. Davies,** Institute of Agricultural Engineering, Oxford. 336,009. July 10th, 1929. A conveyor dryer in which the material traverses several compartments on a band has a separate fan serving each compartment capable of dealing with the requisite volume of drying agent for its compartment and independently regulated as to speed. The fan serving the compartment containing the driest material communicates with a controlled supply of heated or pre-heated air while the subsequent fans are separately connected each to its respective compartment and to the previous compartment. Re-heating gases are also supplied in regulated quantities to each compartment for mixing with the drying air. The supply ducts and discharge ducts joining the various fans to the compartments taper from the fan end to the full extent of the compartment.—MOLASSES FODDER. **R. A. Legendre,** of Paris. 336,014. July 13th, 1929. Food for animals consisting of a base such as straw, bran, or oats mixed with molasses is preserved by treating the product to give the moisture contained therein a *pH* value of over 6, preferably a value between 6 and 11. The treatment consists in mixing with the product, or with one or more of its ingredients before preparation thereof, a salt of a strong base, e.g. sodium or ammonium, and a weak acid, or a free base, or mixtures of such salts and bases, alkaline materials containing calcium being excluded. Examples of the proportions of the active substances added in this patent to the food are given. BOARDING FROM BAGASSE. **T. B. Munroe and E. C. Lathrop.** 335,052. September 14th, 1929. Hard, grainless boards, etc., are made by subjecting cellulose fibres having about 50 per cent. water content to a pressure of the order of 500 lbs. per sq. in., and simultaneously to a temperature of about 350°F., until bone-dry. No resins, etc., are present in the mass. The invention is particularly applicable to bagasse, stored in bales and allowed to ferment to break down the cementitious matter holding the fibre bundles together. The bagasse is cooked in a digester, preferably at a steam pressure of 35-40 lbs. for two hours, and treated in a beater which separates the fibres without breaking them. The material is sheeted on a paper machine, made into boards, etc., and pressed and heated as above. If necessary, 5 to 20 per cent. of paper stock is added to the fibres.—BEET SYRUPS FOR JAM MAKING. **A. W. Beach,** of Richmond, Surrey. 336,321. July 22nd, 1929. In the manufacture of jams, marmalade, conserves, confectionery, etc., the sugar is added in the form of an aqueous solution, containing, preferably, 40 per cent. or more of sugar, obtained by lixiviation or diffusion treatment of sugar beet. The sugar solution may be obtained by diffusion treatment of dried cossettes of beet, the solution being concentrated until its sugar content is about 40 per cent., clarified, e.g. by filtration, and subjected to a lime or other treatment to remove albuminoids, the purification being effected so as completely to clarify and decolorize the solution and remove suspended impurities. (Reference has been directed by the Comptroller to specifications 136, 205, 147,838 and 148,407).—SACCHARIFICATION OF CELLULOSE. **Commercial Alcohol Co., Ltd., J. S. Arthur, and R. Gogarten.** 336,934; 336,935; 337,017. April 20th, 1929. Relates to making decomposition products such as polyoses and monoses from cellulose and cellulose-like substances by hydrolysis with acids,

United States.

(*Willett & Gray*).

(Total of 2,240 lbs.)	1931 Tons.		1930 Tons.
Total Receipts, Jan. 1st to Feb. 21st	301,325	..	296,413
Deliveries ,, ,, ,, ...	315,609	..	376,417
Meltings by Refiners ,, ,, ...	296,045	..	378,784
Exports of Refined ,, ,, ...	1,500	..	8,212
Importers' Stocks, Feb. 21st	161,608	..	357,267
Total Stocks, ,, ...	266,948	..	514,494
	1930		1929
Total Consumption for twelve months	5,599,377	..	5,810,980

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT DECEMBER 31ST.

(Tons of 2,240 lbs.)	1928. Tons.		1929. Tons.		1930. Tons.
Exports	3,728,618	..	4,666,944	..	3,051,674
Stocks	124,403	..	181,460	..	687,056
	3,853,021	..	4,848,404	..	3,738,730
Local Consumption	68,857	..	98,362	..	76,185
Receipts at Ports to December 31st ..	3,921,878	..	4,946,766	..	3,814,915

Habana, December 31st, 1930. J. GUMA.—L. MEJER.

Sugar Crops of the World.

(*Willett & Gray's Estimates to February 19th*, 1931.)

	1930-31. Tons.		1929-30. Tons.		1928-29. Tons.
CANE.					
America	7,364,562	....	9,001,576	....	9,209,133
Asia	7,773,391	....	7,344,208	....	7,318,783
Australasia	622,477	....	626,239	....	633,066
Africa	791,000	....	747,491	....	748,468
Europe	14,000	....	13,562	....	11,610
Total Cane	16,565,430	....	17,733,076	....	17,921,060
BEET.					
Europe	10,488,100	....	8,219,148	....	8,469,491
U.S.A.	1,070,000	....	901,713	....	938,640
Canada.............	39,000	....	27,869	....	28,857
Total Beet	11,597,100	....	9,148,730	....	9,436,988
TOTAL CANE AND BEET....	28,162,530		26,881,806		27,358,048

United Kingdom Monthly Sugar Report.

Our last report was dated February 10th, 1931.

Markets have been in a stagnant condition during the month under review and there is only a little change in price to report.

With regard to the stabilisation plan, Mr. CHADBOURNE who has been in Cuba has just arrived back in Europe and will attend a new conference to be held probably next month in Cannes to ratify the agreements that the various European Committees have entered into.

Apparently about 79 per cent. of the Dutch producers in Java are now in agreement, and it is generally believed that the Dutch Government will give their consent to the restriction of exports.

The London Terminal Market has been steady and rather better, until the last week, when prices have sagged again. About 7000 tons was tendered on March and this month moved from 5s. 8½d. to 5s. 11½d. to 5s. 8d., May advanced from 6s. to 6s. 3d. to 5s. 10d., August sold from 6s. 3d. to 6s. 6½d. to 6s. 1d., whilst December moved from 6s. 7d. to 6s. 10½d. to 6s. 5d. March 1932 was traded in from 7s. 2½d. to 6s. 8¾d. The last few days, however, have seen a slight recovery.

The latest prices are :—

	MARCH	MAY	AUGUST	DECEMBER
Raw	5s. 10½d.	6s. 0d.	6s. 3½d.	6s. 7½d.
White	7s. 6d.	7s. 9d.	—	—

The demand from the trade has been meagre except for a burst of buying at the end of last month. Refiners prices are 6d. higher than a month ago, No. 1 Cubes being quoted at 23s. 6d. and London Granulated at 19s. 10½d. The Home Grown Factories have made no change in their prices.

Business in Raws has not been brisk, but has been confined to parcels of 96 per cent. Cane from 6s. 3d. to 6s., but a fair business has been done in Continental Beet from 6s. to 5s. 9d. c.i.f.

The American refiners are only experiencing a moderate demand and have not been anxious buyers of raws. Cuba still keeps out of the market, but the Philippines and Porto Ricos have sold heavily.

No further sales of Russian Sugars have been made, and the Russian crop is probably falling 400,000 tons short of the 2,000,000 tons estimated.

In most European countries there will be a 10 per cent. to 15 per cent. reduction in the sowings.

The Dutch Government has introduced a Bill to subsidize the growing of beet in Holland, but in spite of this it is estimated that the Dutch crop will be 25 per cent. to 50 per cent. less.

An arrangement has been come to with the English Beet factories, by which the Government are granting a further subsidy of 1s. 3d. per cwt., based on a price of 6s. 6d., c.i.f. London, for 96 per cent. Cubans.

There are some factories which, so far, will not take advantage of this offer, and it is thought the English crop will be 30 per cent. to 40 per cent. smaller than last year.

21, Mincing Lane,
London, E.C.3.
11th March, 1931.

ARTHUR B. HODGE,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 388. APRIL, 1931. Vol. XXXIII.

Notes and Comments.

The Chadbourne Negotiations.

Nothing has occurred during the past month to weaken the belief that the successful outcome of the Chadbourne international negotiations is in sight. Mr. Chadbourne returned to Paris the first week in March and since then has been interviewing individual delegations to clear up points in dispute and prepare the way for a plenary conference which at the time of writing (the first week of April) is engaged with the settlement of all outstanding questions for the common agreement. It is understood that ratification will take place at a subsequent meeting, and unless there is an unexpected prolongation of the final negotiations, it seems likely that the ratification will be a fact before April is out.

Amongst the questions to be settled, the following have been indicated by Mr. Chadbourne in an official communication. A permanent international commission needs to be set up to supervise the operation of the pact, and its constitution and the basis on which delegates shall vote on it must necessarily be settled. A location for the headquarters of the permanent commission needs likewise to be fixed, as also a permanent chairman and chief executive officer. A more difficult problem is to devise a plan through which the export quotas of the respective countries can be augmented in the event of the international sugar market disclosing an increased demand, so as to restore the equilibrium between supply and demand and counteract any tendency for the price of sugar to rise abnormally. These and other points are now doubtless receiving the attention of the plenary conference. As to their outcome, we cannot do better than quote the confident opinion of F. O. Licht to the effect that whatever preliminary skirmishes there may be amongst the delegates, there is no doubt whatever that the meeting will be crowned with success, and that the further meeting for ratification will follow as a matter of course. By the time these lines are read, the final lap of the negotiations may, indeed, have been entered.

Java's Participation assured.

We were not left long in doubt about Java's determination to " see things through," for on March 18th the People's Parliament of the island passed the new Licensing Law providing for the limitation of exports from Java, the voting being 13 to 5, with 2 abstentions. According to LICHT, the minority of five included a Dutch Social Democrat, a native communist, and three other natives ; not one member of the parties representing the interests of the sugar industry voted against the Law. It appears now that 78·2 per cent. of the Java sugar industry was in favour of the Chadbourne Plan, 16·7 per cent. against it, and 5·1 per cent. remained neutral. The Parliamentary opposition stressed the argument that the Plan would have no lasting effect, since the participants controlled only about 50 per cent. of the world production, and the outsiders, including Russia, would render the attempt a failure. It was also suggested that the participation of Cuba was in doubt owing to the presence of disruptive forces in that island. The Java Government, however, stuck to its conclusion that the participation of Java in the Plan was both necessary and desirable, and so passed the Law ; but for certain technical reasons no time period was incorporated in the measure, though it is understood that the provisions can be extended from time to time by means of a Government Decree. Following on the passage of the Law, an advisory committee of the representatives of the sugar industry was formed under Governmental aegis to arrange the provisions for working the agreement. Export restrictions come into force from April 1st, and steps have also to be taken to restrict the plantings for the 1932 crop. The needed legislation has, therefore, been completed none too soon.

LICHT mentions that two arguments that weighed with the Java Government were that, even if Java held aloof, the European participants and Cuba would be likely to sign an agreement, so it was better for Java to join too ; and that, so far as the threatened Russian competition was concerned, it would eventuate whether the Chadbourne Plan was agreed to or not, and in front of this danger it was better to stand united.

The European Beet Sowings.

The next important factor in the situation is the size of the coming European beet crop. The sugar market has awaited with more than ordinary interest the publication by the firm of F. O. LICHT at March 31st, of the first estimate of sowings. A decrease has been anticipated for some weeks past, so it is not surprising to learn that, in LICHT's view, it will amount to 14·8 per cent. for Europe without Russia. This, in round figures, means one and a half million tons less of sugar as compared with 1930 (without taking into consideration weather averages). Russia is officially credited with the intention to increase her area by 338,000 hectares or 32·4 per cent. which, if it eventuated, would mean an increase for all Europe of 1·9 per cent. But LICHT observes that since Russia has not been able to work all the yield of the acreage sown in 1930—1,044,000 hectares, it appears more than doubtful—not to say impossible—that the 1931 proposed area of 1,382,000 hectares can be worked, nay even that it can all be sown. For the present, then, the Russian figures must be taken with the necessary admixture of scepticism.

As regards the rest of Europe, the German statisticians report that nearly everywhere field operations are much in arrears owing to the unusually late Spring, and hardly any seed drilling has as yet been attempted. There is also the point that negotiations resulting from the Chadbourne Plan had in many cases not been concluded, so that arrangements between the industry and the

beet farmers tended to be in a state of suspense down to the last moment. For these reasons any accurate estimate of the impending sowings has been a matter of great difficulty; but it seems certain that the decrease is assured. And the weather factor has still to be estimated; in 1930 the weather (and hence the yield) was much above the average of the past few years. If the 1931 season is only an average one, the output of sugar, as compared with last crop, will tend to suffer more of a decrease than the 15 per cent. indicated by the reduced sowings.

The Outlook.

The subscription of Java is of course a bull point in the immediate outlook; and the reduced sowings in Europe lend considerable strength to the restricted export plan of the beet sugar participants in the Chadbourne pact. Less definite factors are that both Peru and the Dominican Republic are reported to be willing to accept a reduction in exports by 15 per cent.; and that persistent negotiations are in progress to include Great Britain, France, Jugo-Slavia, Austria, Italy, Argentina, Japan and Russia in the international agreement. It may be said, at least, of these countries that they will not be slow to see the advantages of joining in an agreement that has already secured so large a share of support from the big sugar exporting territories.

When we turn to the sugar market and note the effect so far on prices due to impending events, it has to be conceded that the task of breaking the vicious inertia that has infected market prices for so long is a bigger one than was possibly anticipated six months ago. Certainly it seems clear that any other, half-hearted, action that might have been attempted by one or two countries would have failed to make any breach in the wall of opposition to a price advance. As with Cuba's earlier restriction schemes, history would have repeated itself. But the present scheme is too big and too thorough in its ramifications to justify the market sceptics in ignoring it for much longer. All the same, the task of getting rid of the incubus of surplus stocks is going to take some little time yet; how long, is probably more psychological than statistical in its solution. The market may at worst persist in its lethargy till it is faced with an actual shortage (apart from the segregated sugar); or it may take fright and start a real buying movement, in which event it is impossible to say how far this will go or how long it will take to raise prices to the standard economic level at which CHADBOURNE is said to aim.

Market reports seem now agreed that a more hopeful view is being taken, and of late prices and turnover have been on the upward move. Invisible stocks are admittedly much reduced and distributors have every incentive to replenish while prices are still low. For the moment, however, the refiners have satisfied their requirements for a few weeks ahead, while the distributing trade are watching the market; as for the sellers they are as a whole standing firm. In America, however, the refiners have bought large amounts of American territorial sugars and so are able for the time being to dispense with supplies from Cuba. The Philippines, indeed, are rumoured to have disposed of their whole crop at current low prices.

It will probably take several months yet for excess supplies to come off the market offerings. Meantime, present prices, which are at a parity of 1·35 to 1·40 cents at the time of writing, are still far below the parity prevailing twelve months ago, though considerably better than the lowest of the past winter. New York has the chief influence on the trend of prices; and a considerable amount of opposition undoubtedly exists there to the new restriction plans, especially amongst the refining interests who may be ex-

pected to throw their weight into the scale of influences directed against an improvement in prices. But with over two million tons to be segregated from the world's markets, and the prospect of reduced crops in the coming campaign, the weight should prove greatest in the other pan of the scales. It is interesting to note that, according to CZARNIKOW, a 3 per cent. increase annually in world consumption is equal over five years to a total of 3,750,000 tons.

Increased Sugar Protection for India.

The *Times* states that the Indian Budget now going through the final stages of consideration by the Indian Legislature at New Delhi provides for an increase of Rs. 1¼ (1s. 10½d.) a cwt. on imports of all grades of sugar. The rates hitherto imposed have been Rs. 6 a cwt. on sugar 23 D.S. and above; Rs. 5¼ between 23 and 8 D.S.; and 25 per cent. *ad valorem* on other descriptions, subject to an addition of Rs. 1½ on certain categories. When Sir GEORGE SCHUSTER was on the point of completing his Budget proposals recommendations were received from the Tariff Board for the protection of sugar. Under these proposals there would be a basic duty of Rs. 6¼ per cwt. on all classes of sugar, including sugar candy, over a period of 15 years. An additional duty of R.1 a cwt. on all classes of sugar would be imposed for the first seven years; and power would be taken to add 8 annas (9d.) a cwt. to the duty at any time if the landed price of sugar at Calcutta *ex* duty fell below Rs. 4 a maund. It will be seen, then, that these recommendations of the Tariff Board are being accepted in their broad basis by the Indian Government.

The "Report of the Indian Tariff Board on the Sugar industry" has now been published, and we hope next month to give a reasoned summary of its findings. The following data present very briefly the position. The area under cane in India over a series of years has remained very steady, the average during the last 20 years being 2,840,000 acres. The main sugar product in India is *gur*, of which between 2½ and 3 million tons are consumed annually. There are at present 29 factories capable of manufacturing white sugar direct from cane; there are also 14 refineries which manufacture white sugar direct from *gur*. The total amount of white sugar by factories and refineries amounts to about 100,000 tons annually. To this must be added about 200,000 tons manufactured annually by the common indigenous process known as the *bel* method. Imports of white sugar now approximate to one million tons, which figure, as compared with pre-war ones, shows an increase of 375,000 tons.

In spite of a remarkable increase in the efficiency of extraction of Indian factories within the last decade, and the introduction of improved varieties of canes giving an increased output of 50 per cent., the cost of production is such that during the next 15 years it is estimated that the basic fair selling price for Indian produced sugar will be not less than Rs. 8-13-1 per maund (of 82⅓ lbs.), whereas it is possible to land foreign white sugar at Calcutta at Rs. 4 a maund. The assistance of a protective duty is therefore considered essential. Even the *gur* industry is threatened by recent imports of Java *gur* and by the manufacture of imitation *gur* from imported sugar. The Tariff Board urge the granting of protection, *inter alia*, because it is considered essential in the national interests that the area under cane should not diminish and that a fresh outlet for cane should be provided by encouraging the expansion of the white sugar industry. They therefore suggest a period of protection amounting to 15 years.

Mr. Earl D. Babst on the Sugar Outlook.

Mr. EARL D. BABST, Chairman of the American Sugar Refining Company, has always something interesting to say in the course of his annual Report on the outlook in the sugar industry.

During 1930, he states, the complexities of the sugar industry increased, due largely to attempts in various countries to overcome the world-wide lack of balance between production and consumption and to give preference to domestic producers. " Sugar continues to hold a fascination for economic experiment . . . Nationalism everywhere, in its effort to save local high cost producers, is destroying producers in low cost fields, even in Cuba whose climate and soil are ideal for sugar production." Mr. BABST then proceeds to discuss not the Chadbourne Five-Year World Plan, as one might expect, but " Cuba's Five-Year Programme " on which he directs all his criticism. He makes strong play of Cuba's failure in the past to regulate production, but ignores almost entirely the new factor in the situation, the participation in the programme of such important other producers of sugar as Java and the European beet interests ; while when he does refer to the restriction proposals he attaches most importance to naming those countries that are not yet participants, and which he deems will render the pact unworkable. Incidentally, Mr. CHADBOURNE'S name is not once mentioned in the argument. It seems clear that the American refiners are totally inimical to the sugar stabilization plans of their fellow-countryman.

In respect to Cuba, Mr. BABST points out that her new programme requires Cuban producers as a whole to cut down their 1931 production 36·5 per cent. under their average production for 1929 and 1930, and forbids them to distribute in their normal U.S. market a certain part of the curtailed amount that they can produce. These two limitations combined mean that an average Cuban producer can produce and market normally a 1931 crop of only about 52·5 per cent. of his average crop of 1929 and 1930. In the case of the two Cuban centrals controlled by the American Sugar Refining Company, which during 1929 and 1930 produced an average of 181,744 tons per crop, they will under the new programme of restriction be allowed to produce during 1931 only about 64 per cent. of that average, and to export to the United States only about 52·5 per cent.

Mr. BABST considers that the normal Cuban sugar markets, denied their usual supplies of Cuban sugar, must make up the deficiency from other sources, usually Domestic beet and cane sugar, which sources, once entrenched, will demand additional artificial protection to permit them to survive, no matter how uneconomic their survival may be, after Cuba abandons restriction and diversion and tries to regain those lost markets. " The only possible justification for all of this far-reaching invasion of property rights in Cuba would be a resulting increase in the price of raw sugar to such an extent that producers would net more from their curtailed output than they would have netted, except for restriction, from a normal output," which result, in Mr. BABST'S experience, is unlikely. " The whole Cuban programme is calculated to save high cost producers in Cuba. Their situation, however, has become worse with each attempt to shield them from inexorable economic laws." This admittedly was true of the earlier attempts at restriction, but we have more than an idea that the Chadbourne plan will now tend to weed out the high cost producers to the ultimate benefit of the low cost ones.

Of course, to the American refiners with their 70 per cent. excess capacity, this big reduction, when compared with the Cuban crops of a few years ago,

with their ample supplies of cheap refining sugars, is a proposition that must handicap them further, especially those operating on the Atlantic seaboard. They indeed are assured of the U.S. internal market for refined sugars, but any hope of supplying also extra-American markets with refined (the main idea that was at the back of the big post-war expansion in refining capacity) seems doomed to indefinite postponement.

"Gird up Your Loins."

On another page we reproduce a trenchant article by Dr. FRANCIS MAXWELL, on the need for both sugar machinery manufacturers in this country and the prospective buyers of their machinery abroad to take time by the forelock and get ready for the improvement in the sugar market that seems due to arrive before very long. Dr. MAXWELL possesses the wide experience that comes to those whose work or inclination affords them the opportunity to travel far and wide in the sugar-producing regions of the world. As a trained engineer and sugar technologist, he has been able to make the most of his observations and has had unusual facilities for studying the problems of the sugar machinery market from an international point of view, and on the spot too. What he therefore writes is well worth careful consideration on the part of those concerned. He urges machinery manufacturers at home to cease " marking time " and to prepare adequately for the return of good business, the advent of which cannot be far off, in view of the excess of wear to which existing sugar machinery has everywhere been put in these uneconomic times. Incidentally, he stresses the advantage of regular and adequate advertisement, which at the least is a factor of moral support to the agent and is undoubtedly a measure of the advertiser's financial status and technical equipment. As for the sugar machinery user, he is wisely warned not to delay placing his necessary orders till everybody is in the market for new machinery ; the only result of the delay will be to lose him the opportunity of buying at cheap prices, such as at present exist. Finally, Dr. MAXWELL deals with the main obstacle to carrying out this advice so far as the British colonies are concerned, the lack of money, and makes the valuable suggestion that the British Government instead of making alleviation grants to those colonies should loan them money to be spent in buying in Great Britain the machinery needed to bring the factories up-to-date. The engineering works at home need orders to maintain their workers in employment ; the sugar factories abroad need new machinery to enable them to turn out future sugar on the most economical basis.

This suggested *quid pro quo* is a practical one that might well receive Mr. SNOWDEN's attention when he introduces his 1931 United Kingdom Budget at the end of April. It is believed that he will be bound to increase indirect taxation somewhat to meet his deficit, and a change in the sugar duties is not ruled out amongst the fiscal prophets. At the same time Mr. SNOWDEN's well known prejudices against preference duties do not encourage much hope that if he increases, from necessity, the sugar duties he will adjust them on the basis urged by the Sugar Federation of the British Empire, the account of whose deputation will be found on another page. Rather, we fear, will the Federation have to await the access to power of a Conservative Government before their views have a real chance of assimilation.

Notes and Comments.

Proposed Sugar Scholarships for South Africa.

In the *South African Sugar Journal* last Autumn the proposal was mooted of establishing Scholarships to enable promising pupils from Natal sugar estates to study sugar practice in other countries and thereby to give the Natal sugar industry the benefit of their acquired knowledge and experience. A course of three years was suggested, costing about £500 for travelling expenses and £250 a year for tuition and living, or approximately £1250 for the three years' course. It was urged that the course should include a year or so at the School of Tropical Agriculture, Trinidad, and a period at the Audubon Sugar School in Louisiana.

We are not surprised to see that some protests have been received by our contemporary at the suggestion that a course at Audubon should be included in the proposed curriculum.. It may be true that many of the existing technologists in Natal have studied at that school; but then the Trinidad College has not been long in existence. Now that it exists, and has laid itself out efficiently to cater for students from all over the British Empire, its friends may well claim that it supplies all that is needed for the academic course, while its miniature sugar factory serves for the practical application; hence, there is no need any longer to go outside the Empire to obtain the benefits of a school of study. This is not to say that the proposed scholarship is not to include facilities for studying on the spot other sugar industries of the world; but merely that the college course with the academic benefits it confers should preferably be under the aegis of the School which has been founded specially to serve the interests of the British sugar industry. That school, in Trinidad, certainly needs all the support it can get.

The Queensland Sugar Industry, 1929 and 1930.

According to the annual Report of the Bureau of Sugar Experiment Stations of Queensland, to November 1930 (prepared by Mr. EASTERBY), the sugar made in Queensland in 1929 was, in amount, the second highest on record, being 518,516 tons of 94 net titre, as compared with 520,620 tons in 1928, the highest yet produced The production of the various districts in respect to yield of cane per acre ranged from 10·48 tons in the Proserpine district to 24·80 tons in that of Ayr, and in respect of sugar per acre from 1·53 tons in the Bundaberg and Gin Gin districts to 3·68 tons in Ayr. The average tonnage of cane required to make one ton of sugar was 6·91, this being the lowest figure on record for Queensland. The average acreage per farmer worked out at 40, but in the area from Cairns to Townsville was as high as 53. The number of sugar mills remains still at 35, with two refineries—one at Brisbane and one at Millaquin; other sugar refineries treating Queensland sugar are situated at Sydney, Melbourne, Adelaide and Perth. The value of the Queensland output in 1929 is given as £12,330,939.

The output of molasses in 1929 was stated to be 15,861,948 gallons, of which 5,638,465 gallons were sold to distilleries, 4,202,588 were burnt as fuel, 2,382,192 were used or sold for feed, and 2,253,083 gallons were run to waste. It is notable that the amount of molasses run to waste is a decreasing figure, and that, as more molasses has been produced in recent years owing to increased crops, larger quantities are being used for economic purposes. As compared with 1921, the amount sold to distilleries has more than doubled.

No outstanding implements for cane cultivation have been placed on the market for the past 12 months, according to Mr. EASTERBY. As far as cane harvesting machines are concerned, there are at present two receiving trials;

one is the MILLER-OWEN harvester being developed at Mackay, while the other is known as the HOWARD harvester, invented by the originator of the rotary hoe in New South Wales, and has been tried out at Bundaberg. Neither of these machines has so far been able to fulfil all the conditions required for a successful commercial cane harvester, but both show much promise. It is trusted that they will eventually be successful.

What is colloquially known as the "peak year" scheme came into operation in Queensland during 1930. This was the outcome of a conference held in June, 1929, at which it was decided that the highest output of sugar of each mill in Queensland in any one year since 1915 be taken as the limit for any future year's production for that particular mill. All sugar produced by any mill beyond this limit, or any sugar manufactured from cane grown on unassigned lands, shall be deemed to be extra surplus and shall be placed in a separate export pool, the price payable being the netted price realized for all sugar exported. The peak total of all the 35 mills at present operating amounts to 611,608 tons of 94 net titre sugar.

For the 1930 season, official statistics last December put the production, with 35 mills in operation, at an estimated total of 512,657 tons of 94 net titre. The estimated area of cane cut for crushing is put at 230,567 acres, and the estimated quantity of cane crushed as 3,507,827 tons, as against 3,581,265 tons in 1929. On the average 15·21 tons of cane and 2·22 tons of sugar go to each acre crushed, while 6·84 tons of cane were required per ton of sugar.

The American 1930-31 Beet Crop.

According to Messrs. WILLETT & GRAY'S report, the U.S. Beet crop of 1930-31 has ended with a record production, the output of sugar amounting to 1,075,688 long tons from 794,181 acres, which compares with 901,713 long tons from 693,041 acres in 1929-30. The largest previous production was in 1924-25 when 974,185 tons of sugar was produced. The weather throughout the entire growing and harvesting season was generally very favourable, and this was, of course, the principal factor in achieving a record total. The area sown was estimated at 809,493 acres, and that actually harvested at 794,181 acres; the acreage thus abandoned is said to be the smallest ever shown in any campaign. The total quantity of roots sliced amounted to 7,848,514 tons (9·88 tons to the acre), as compared with 6,341,973 tons in 1929-30, while the average yield of sugar per acre was 1·35 tons, against 1·30 tons in 1929-30, 1·42 tons in 1928-29, and 1·33 tons in 1927-28.

CITY AND GUILDS EXAMINATIONS.—A good number of entries from different countries have now been received for the City and Guilds of London Institute's examinations in Sugar Technology, which are held in May. The number from South Africa, viz. 26, constitutes a record.

CYCLONE IN MAURITIUS.—A cyclone of unusual severity passed over Mauritius during the first week of March, causing considerable damage and loss. Estimates of the extent of such havoc are usually provisional since so much depends on the subsequent weather which may enable the canes to recover; and given favourable weather canes do frequently recover appreciably from cyclonic damage. On the estates of the Anglo-Ceylon & General Estates Co. the estimated figures of loss vary between 15 to 20 per cent. in the north of the island, and 30 to 35 per cent. in the southern districts. The centre of the hurricane passed over the southern portion of the island. On the whole it was estimated that some 25 per cent. of an excellent crop anticipated before the hurricane had been lost. These figures apply to one firm, but are some indication of the effects on the whole industry, so far as details are available.

ESTD. SMITH 1837.

DESIGNERS AND MANUFACTURERS
OF

CANE SUGAR MACHINERY

OF EVERY DESCRIPTION

THREE 11 0 DIAM COIL TYPE VACUUM PANS
EACH
1,000 SQUARE FEET HEATING SURFACE

A. & W. SMITH & Co. LTD.

Eglinton Engine Works, GLASGOW

TELEGRAPHIC ADDRESS • "ENGINE," GLASGOW
LONDON OFFICE — 8, GROSVENOR GARDENS, S.W.1.

"Marking Time."

Its Effect in Britain and certain Crown Colonies.

By FRANCIS MAXWELL, D.Sc., M.I.Mech.E.

In the last issue of this Journal we find the following passage[1] :—

" In going over the various factories in the Argentine, it is at once noticed how little of the plant has been manufactured in Great Britain. The modern equipment is variously German, French, Czecho-Slovakian and American manufacture. When most of the factories were first started, 20 or 30 years ago, a great deal of the plant came from Great Britain, but of late years this seems to have changed, which is a great pity."

This, we think, is a timely observation, especially in view of the policy of " marking time " which seems to prevail in the sugar machinery industry.

Take just one item, namely advertising—admittedly a potent factor in trade. The tendency seems to be to cut down expenses in this respect. Here is a striking instance.

What has been done with regard to the great push for the South American markets under the dynamic leadership of the Prince of Wales himself ? How many of the sugar machinery firms have availed themselves of the unique chance offered by the British Empire Trade Exhibition recently inaugurated by his Royal Highness at Buenos Aires ? According to the official list of exhibitors, there is only one—a single, solitary firm of sugar machinery manufacturers that has taken a stand.

Again, one of the leading London papers issued at an opportune moment an English-Spanish supplement concerning the potentialities of Anglo-South American trade, which has received wide attention and admiration. Among the numerous and multifarious industries in Great Britain represented therein, the sugar machinery industry was conspicuous by its absence. The same applied to an engineering supplement in both languages.

It may be said, and indeed is being said, that it pays better to rely on agents working on the spot than on other methods of advertisement. But is this so ?

The limitation of an agent's approach to those who direct the purchasing department of sugar concerns is best appreciated by the agents themselves. Whereas advertisement in the nature of working models in exhibitions or attractive displays in the leading trade papers may go a long way to effecting an order, or at the least it forms a welcome moral support to the agent.

Another doleful aspect of 'marking time' is the policy of hanging on to machinery that has out-lived its economic existence, or of nursing stacks of antique patterns and designs that are useful only for a bonfire. While far-sighted firms abroad have been, and are, silently but resolutely and thoroughly, raising their competitive efficiency to the highest level attainable in modern times, there are, we fear, firms at home that are complacently jogging along on the path of mildewed conservatism—and possibly to bankruptcy !

It is true that orders for sugar machinery have been for some time, and still are, distressingly scarce. But how long is this dearth going to last ? Apart altogether from the inevitable swing of the economic pendulum, which incidentally has had a push in the right direction by the CHADBOURNE Plan, the following consideration is apt to be lost sight of.

Sugar factories, which, for one reason or another, have been carrying on during many lean years with the same plant, a greater or less portion of which probably is on its last legs, and with the least possible repairs or renewals,

[1] *I.S.J.*, 1930, 116.

will find that the time is coming—as assuredly it is bound to come sooner or later—when these wearing and over-burdened machines will break down.

It may be that such a process of breaking-down may affect a number of factories in different lands simultaneously or more or less so, with the consequence that there will be a rush for orders of sugar machinery. Should this period, moreover, coincide with a favourable turn in the sugar market, the rush would be greater, and the prices would soar.

Factories, which adopt a prudent policy of keeping their equipment up to scratch in these times, will get their plants at a low price and be, moreover, fully prepared to obtain the greater benefit when the time arrives. Whereas those which are caught napping will have to pay dearly for new plants when the rush is on, and will be handicapped at the turn of the economic cycle.

As to the sugar machinery firms, those who have been constantly sowing the seed in these bad times, by keeping their goods well to the fore by regular advertisement, and by raising the efficiency of their works, will naturally reap the greatest benefit from such an influx of orders.

Let us now direct our attention to the position of certain Colonies within the British Empire, who, owing to the desperate state of their sugar industry, have been visited and reported upon by Commissions appointed by the Imperial Government, namely Mauritius and the British West Indies.

Concerning Mauritius, we cite the following relevant remarks by the Secretary of the Society of Chemists of Mauritius in regard to the equipment of factories on that island :—[1]

"The machinery is chiefly British make, but with the exception of about a dozen factories the plant is old and lacks that homogeneity which characterizes modern sugar-houses . . . .

"Unfortunately a series of bad years since 1923 have greatly hindered that forward move, and the low price ruling for sugar for some time has put a complete stop to progress in factory equipment . . . . .

"The writer has just gone into the question of milling improvements, and in his opinion and that of many others in the sugar business, it is high time to discard many obsolete machines and replace them by modern units. Much indeed has to be done, but money is not to be found . . . . .

"As matters stand there is still much to be effected in the milling plants of Mauritius, either in scrapping the weaker and older mills or again in creating modern centrals. This will have to come sooner or later. Only milling equipment has been considered here ; but it is not a moot point that there is more scope for amelioration in the other departments of our sugar-houses, in evaporators, barometric condensers, vacuum pans, boilers, travelling cranes, etc. . . .

"Manufacturers of machinery and other equipment in the British Isles would assuredly welcome a change for the better in our staple industry, as this would undoubtedly mean the resumption of orders and the transaction of business to our mutual satisfaction."

Such is the case with Mauritius, and similar conditions no doubt prevail in the West Indies.

Sugar concerns in these Colonies are in a very grave financial dilemma. And let it be said at once, that with them, on the whole, marking time is a policy dictated by dire necessity ; and, without the financial assistance of the British Government, they are doomed to drift on precariously while the competitive efficiency of their factories must necessarily continue to deteriorate at a rising rate. As matters stand, even those who can keep on their feet

[1] *I.S.J.*, October, 1930, 511.

until the "economic blizzard" blows over or State assistance is forthcoming, will find that a great deal will have to be done before their factories are reconditioned on a competitive basis.

The crux of the position may be expressed thus :— Factories in these Colonies want machinery, while sugar machinery firms in Great Britain want orders, but there is no money for the transaction.

Now, since the British Government has turned down the granting of loans in the nature of those recommended by both the West Indian and Mauritian Commissions, the following proposition—which does not appear in the recommendation of either Commission—might be considered as an alternative :—

That the British Government offer a loan to the British West Indies and to Mauritius for the purpose of enabling the factories concerned to recondition their factory equipment on a competitive basis, on the condition that the total sum granted must be expended in orders for machinery to be placed and manufactured in Great Britain.

By this procedure, the following is attained :—

(1) The Colonies will at least be enabled to put their factories on an efficient competitive basis at the relatively low prices now prevailing in the machinery market.

(2) The sugar machinery works in Great Britain will be enabled to maintain and give employment to thousands of workmen.

(3) The money paid by the British taxpayer for the loan is spent at home, and spent profitably.

The Java 1930-31 Crop.

First Estimate of the V. J. P. Factories.

The first estimate of the Java 1930-31 sugar crop has just been issued and consists of the following :—

	Metric Tons, telquel
Superior Head Sugar	1,920,000
Superior Soft Sugar	5,000
Raw Sugar, basis pol. 98·0	791,000
Molasses Sugar	35,000
Total V.J.P. Factories	2,751,000
Other factories (10 per cent.)	275,000
	3,026,000

which, on Head Sugar Basis, is equal to 2,968,000 long tons.

How this works in with the allowable export under the Chadbourne plan is shown by the following figures :—

	Metric Tons
Stock on 1st April 1931	550,000
Crop of 1931 (say)	3,020,000
Total disposable	3,570,000
Consumption (April-March)	500,000
Disposable for Export	3,070,000
Exportable Allowance (2,200,000 + 100,000)	2,300,000
Stock to be expected at 31st March, 1932	770,000

British Empire Preference and the Sugar Duties.

Deputation of Producers and Refiners to the Treasury.

The Rt. Hon. L. S. Amery, M.P., Chairman of the Sugar Federation of the British Empire, led a deputation representing the principal associations of sugar producers and refiners throughout the British Empire to Mr. Pethick-Lawrence, Financial Secretary to the Treasury on Monday, March 23rd. Mr. Snowden, the Chancellor of the Exchequer, had agreed to receive the deputation, but owing to his ill health it was received by the Financial Secretary.

Mr. Amery presented a memorandum giving a brief statement of the case. This was as follows :—

The deputation requests that H.M. Government consider increasing the duty on importation of non-preferential sugars only. It suggests that the duty be raised by 2s. 4d. per cwt. on non-preferential sugars the polarization of which exceeds 98°, with a corresponding increase for sugars of other polarities, the existing rates for preferential sugars to remain unchanged, except only on sugar exceeding 99° where the suggested rates have been so adjusted as to cover the recent additional subsidy to beet sugar without altering the differential given to British refiners (and by them transmitted to the consumer) in the 1928 Budget.

The nature of the change proposed is shown in the appended table for sugars exceeding 92°.

UNITED KINGDOM IMPORT DUTIES ON SUGAR.

PRESENT RATES.

	Full Duty.		Preferential Duty.		Amount of Preference.	
	s.	d	s	d	s	d
Not exceeding 93°	7	5·6	4	0·5	3	5·1
,, 94°	7	8·2	4	1·9	3	6·3
,, 95°	7	10·9	4	3·3	3	7·6
,, 96°	8	1·6	4	4·8	3	8·8
,, 97°	8	4·3	4	6·3	3	10
,, 98°	8	7	4	7·7	3	11·3
,, 99°	11	8	4	9·2	6	10·8 (a)
Exceeding 99°	11	8	5	10	5	10 (b)

PROPOSED RATES.

	s	d.	s	d	s.	d.
Not exceeding 93°	9	4	4	0·5	5	3·5
,, 94°	9	7·3	4	1·9	5	5·4
,, 95°	9	10·6	4	3·3	5	7·3
,, 96°	10	2	4	4·8	5	9·2
,, 97°	10	5·4	4	6·3	5	11·1
,, 98°	10	8·8	4	7·7	6	1·1
,, 99°	14	0	4	9·2	9	2·8 (c)
Exceeding 99°	14	0	6	11	7	1 (d)

	s.	d
a Effective preference (approximately)	4	1
b ,, ,, ,,	3	6
c ,, ,, ,,	6	3
d ,, ,, ,,	4	9

In support of the proposals the following considerations are respectfully submitted :—

(1) The price of sugar to the consumer should not be increased by such a step more than ¼d. per lb.

(2) It would cause the Canadian Government to make such adjustments in their tariff as would attract to the Dominion about the same amount of Empire sugar as is now imported there.

(3) The British beet sugar industry is not represented on this deputation and has not been officially consulted. The deputation is, therefore, not concerned with re-opening the discussions which have taken place with that industry, though

it has provisionally suggested a rate for sugar above 99° which would, if applied to beet sugar, take the place of the special advance recently offered.

(4) Such a step would effectively relieve the sugar industry of the Empire from the existing depression, and particularly the industry in Mauritius, British Guiana and the West Indies, where, failing an immediate and very material rise in the market price, it is threatened with extinction. The salvation of the cane industry in the above mentioned colonies would relieve the Government from the necessity of finding funds to support the unemployed labourers in those countries, whose numbers are bound to increase if the industry goes to the wall, as well as help British trade with those Colonies.

(5) Such a measure as is proposed would bring about the expansion of the industry in the Dominions producing sugar (South Africa and Australia) which would lead immediately to very considerable orders for plant and machinery from this country, thus increasing employment here.

(6) All these benefits could be secured without any cost to the Treasury. The revenue would in fact be considerably augmented, probably by at least £3,000,000.

In explanation of the Memorandum, Mr. Amery made the following remarks :—

Our object is to put before you a suggestion for meeting the very critical situation in the sugar industry, more particularly in the West Indies, British Guiana and Mauritius, and to do so on lines which would involve an actual reduction of some of the sums which are being spent in that connexion at this moment and a still more substantial increase of general revenue.

Position in Mauritius and West Indies.—The situation in the sugar producing colonies, Mauritius, British Guiana and the West Indies, is at least as pregnant with disaster to-day as it was when Lord Olivier and Sir Francis Watts made their very serious reports over 12 months ago. In the case of Mauritius it has been aggravated in the last few weeks by a terrible hurricane.

It is enough for my purpose to-day, to point out that very large supplementary estimates have been presented to the House of Commons, which are in substance grants-in-aid—one might really say doles—both to the governments and to the populations of some of those colonies ; and there is no evidence that under present economic conditions this assistance may not have to continue indefinitely. Even in the case of a more prosperous colony like Jamaica, I understand that they have decided to approach the Imperial Government for the remission of the £60,000 a year which they have hitherto been paying as a contribution to the cost of the war.

And yet, side by side with this disastrous situation, the fact remains that these colonies can produce sugar efficiently from the technical point of view, as the reports of Sir Francis Watts and Lord Olivier have shown, and can produce it at a price well below the average price at which most of the world's sugar is produced, though not below the price at which the world's surplus is disposed of in what I may call the residual market. Given a reasonable price those colonies could pay their own way ; they could maintain by their exertions a standard both of governmental efficiency and of social conditions which would be not unworthy of their place in the Empire. To-day, without the heaviest financial subvention they are quite incapable of doing that. And further, if enabled to stand on their own feet they would as purchasers of British goods, more particularly, among other goods, of British sugar machinery, make an appreciable contribution toward the solution of our economic difficulties here.

Sugar-Producing Dominions.—What applies to the sugar producing, colonies in this latter respect applies no less to the sugar producing Dominions.

for any extension of their sales of sugar to this country would greatly increase their capacity for reciprocal purchases from us. That capacity is much higher per lb. than is the case with any foreign country from which we purchase sugar. A very much greater proportion comes back to us in orders for British goods from Australia and South Africa than from Cuba and Java. As regards South Africa—the sugar industry there has expanded very considerably in recent years and is to-day very near the margin of its factory equipment. Any alteration in economic conditions which would justify considerable increase in the acreage put under cane in South Africa would at once lead to re-equipment and reconstruction of factories on a considerable scale; and in that connexion I should like to remind you of the fact that, much more by deliberate voluntary preference than by the smaller preference accorded in the Union tariff, the South African sugar people have ever since the stabilization of the sugar preferences a few years ago given practically the whole of their orders for sugar machinery, amounting to very many thousand pounds, to this country. Therefore, anything which would involve re-equipment on a large scale might be a very great assistance to us.

Alterations of Duty Suggested.—The form in which we suggest that this assistance should be given is the raising of the duty on non-preferential sugar by 2s.4d. for sugar of a polarization exceeding 98°, with a corresponding increase on sugar of lower polarities, leaving the rates for preferential sugar unaltered. In justification of this proposal I should like to point out that the price of sugar has fallen enormously in recent years; and, apart from the big reduction in duties made in 1914, that actually since duties have been situated at their present level since 1928, fine granulated sugar has fallen from 28s. 6d. to 18s. 9d. per cwt., a fall of very nearly 1d. per lb. to the consumer, and that the increase of duty which we recommend, which would at the very most amount to ¼d. per lb., could not be regarded as inflicting any hardship on the community as a whole.

We are only asking for what we consider sufficient, but not more than sufficient, to put the sugar producing colonies on their feet and to produce the other desirable results in regard to Empire trade generally to which I have referred. It is a point worth mentioning that some of these colonies live side by side with sugar producing colonies under the French and American flags which even under present conditions are enjoying a very considerable prosperity. I do not think it is good that that contrast should be all the time before our people or before foreign countries.

The Canadian Preference.—One incidental point is that the carrying into effect of our proposal would make it almost inevitable that the Canadian Government would increase its preference to the West Indies—perhaps to other sugar colonies as well. The present Canadian preference is 1s. per cwt. higher than ours. But under these conditions a very considerable proportion, not only of West Indian sugar but also of sugar from other parts of the Empire, is drawn into Canada. If there were any danger of our preference deflecting any sugar from Canada, the Canadian refiners would immediately exercise pressure on their government to bring their preference to the level of our own.

The Financial Secretary, Mr. F. W. PETHICK-LAWRENCE, in reply said that he would undertake to pass on what had been said to the Chancellor, who would thereby have the benefit of this full expression of the deputation's views in considering the whole matter.

The Members of the Deputation consisted of the following :—The Rt. Hon. L. S. AMERY, M.P. (Chairman); Lt.-Col. IVAN DAVSON, O.B.E. (British Guiana and British West Indies); W. E. R. EDWARDS (South Africa); W. A. HOBBINS, D.S.O. (Australia, Canada, Fiji); Major Sir HUMPHREY LEGGETT, D.S.O. (South Africa); V. A. MALCOLMSON (British Sugar Beet Society); L. H. PIKE (Australia); J. J. RUNGE (British Refiners); The Hon. Sir LOUIS SOUCHON, C.B.E. (Mauritius); and H. T. POOLEY (Secretary of the Sugar Federation).

The Algebraical Theory of the Extraction of Juice by Milling.

By NOËL DEERR

In earlier articles[1] I have given certain of the conditions which obtain when juice is expressed from cane under a system of compound imbibition.

The question has also been developed by PARR[2] who has given a general analysis entailing the use of determinants and also by WACHTENBERG[3] who supplied me with a solution in the form :—

$$R = \frac{r[r^n - (1-r)^n]}{r^{n+1} - 1 - r)^{n+1}}$$

where R is the extraction in the train, r is the extraction by any mill in the train expressed as a function of the combined material presented to the mill and n is the number of mills in the train.

A more detailed analysis with a different derivation and possibly one in a simpler form, is presented below and which for the sake of completeness gives the whole argument.

The extraction of juice by milling may be divided into two operations :—

(*a*) The primary process in which the material is crushed until a balanced condition obtains when no more juice can be extracted by the influence of pressure only. The juice so obtained is termed by the writer primary juice and the residue or bagasse is called primary bagasse.

(*b*) The secondary process in which the primary bagasse is crushed in a train of mills called the imbibition train. In this process water is used as a diluent of the residual juice in bagasse before that mill which is last in series. The dilute juice obtained from this mill is returned to the penultimate mill, this to the antepenultimate mill, and so on.

The material obtained from the mill first in series in the imbibition train is called secondary juice and this mixed with the primary juice is delivered to the boiling-house, the combined material being known as mixed juice.

This scheme of operation with the notation used in the present article is illustrated in Fig. 1. That mill last in series in the imbibition train is lettered 1 and that mill first in series whence is obtained the secondary juice is lettered n. The primary unit then becomes mill $n + 1$. The solids is the juices expressed by the various mills are denoted by $x_1, x_2, \ldots x_n$, etc., and following this notation the solids in the added water, which are zero, are represented by x_0.

The condition laid down in the development of the Algebraical Theory are :—

(*a*) That the bagasse delivered from each mill contains a constant proportion of fibre whence it follows that the quantity of dilute juice expressed by each mill is also constant.

[1] *I.S.J.*, May, 1928, August, 1930. [2] *I.S.J.*, 1921, 562; 1922, 95. [3] *I.S.J.*, 1922, 573.

(*b*) That the water or returned dilute juices mix completely with the residual juice in the bagasse delivered from any mill in the train.

With the notation used by the writer the preliminary data required for the development of the analysis of the imbibition train are :—

Let f = fibre in cane and m = fibre in bagasse which is constant throughout the whole train.

Let w be the water added at mill 1 and let w be expressed in terms of f, so that $w/f = k$.

Then primary bagasse per 1 cane $= f/m$.

The weight of dilute juice obtained in any of the mills in the secondary train per unit of material presented to a mill, including both returned dilute juices and residual juice in the bagasse is :—

$$wm/(f + wm - fm) = km/[1 + (k - 1)] \text{ where } w/f = k.$$

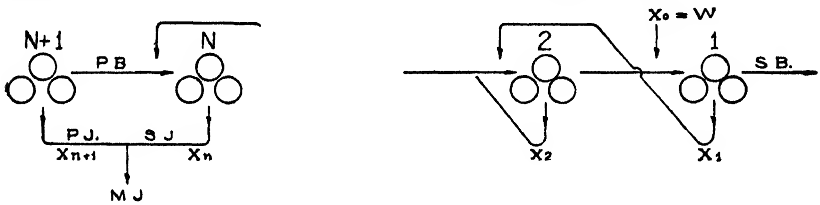
This quantity is the recovery at each mill in the imbibition train and is denoted by r which is called the factor of recovery by each mill of the train.

If R be the recovery in the imbibition train the expression

$$R = \frac{r[(1-r)^n - r^n]}{(1-r)^{n+1} - r^{n+1}}$$

has been given where n is the number of the mills in the train.

This expression is not easy to handle and another derivation of it in a different form with a more complete analysis is offered below.



P.B. — PRIMARY BAGASSE. P. J — PRIMARY JUICE.
S.B. — SECONDARY " . S.J — SECONDARY " .
M.J. — MIXED JUICE. **FIG 1** X_0, X_1 ETC. — SOLIDS % IN JUICES.

Referring to Fig. 1, at the mill last in series, mill 1, water is added to the bagasse issuing from the penultimate mill, or mill 2. The dilute juice from mill 1, is returned to the bagasse coming from mill 3, the combined material being crushed in mill 2. This scheme is systematically continued and the material from mill n being removed to process. The solids in the juices expressed by the various mills in the train are denoted by $x_1, x_2 \ldots . x_n$.

Let the quantity of juice in the bagasse as it is delivered from a mill be unity and let s be the quantity of added water or of dilute juice expressed by each mill of the train.

Then if $x_0 = 0$ be the solids in the added water, evidently

$$(sx_0 + x_2)/(1 + s) = x_1$$
$$\text{or } x_2 = (1 + s)x_1$$

Again at mill 2 :—

$$(sx_1 + x_3)(1 + x) = x_2 = (1 + s)x_1$$
$$\text{or } x_3 = (1 + s + s^2)x_1$$

And generally $x_n = (1 + s + s^2 + \ldots . + s^{n-1})x_1$

If x_{n+1} be the solids in the juice in the primary bagasse :—

$$x_{n+1} = (1 + s + s^2 + \ldots .. + s^n)x_1$$

The quantity of juice expressed by any mill in the train is s times the quantity contained in the primary bagasse, and it therefore follows that the extraction, R, in the secondary train is given by the expression :—

$$R = \frac{s(1 + s + s^2 + \ldots\ldots + s^{n-1})\, x_1}{(1 + s + s^2 + \ldots\ldots + s^n)\, x_1}$$
$$= \frac{s + s^2 + \ldots\ldots\ldots + s^n}{1 + s + s^2 + \ldots\ldots + s^n}$$
$$= \frac{s\,(s^n - 1)}{s - 1} \Big/ \frac{s^{n+1} - 1}{s - 1}$$
$$= \frac{s(s^n - 1)}{s^{n+1} - 1}$$

The identity of these expressions with the previously obtained value of R in terms of r may be established thus :—

Since s is the quantity of added water per unit of residual juice in bagasse

$$s \,/\, (1 + s) = r \text{ or } s = r/\,(1 - r)$$

It then follows that :—

$$\frac{r\left\{r^n - (1 - r)^n\right\}}{r^{n+1} - (1 - r)^{n+1}} = \frac{r^{n+1}\left\{1 - \left(\frac{1 - r}{r}\right)^n\right\}}{r^{n+1}\left\{1 - \left(\frac{1 - r}{r}\right)^{n+1}\right\}} = \frac{1 - \left(\frac{1 - r}{r}\right)^n}{1 - \left(\frac{1 - r}{r}\right)^{n+1}}$$

$$= \frac{1 - \left(\frac{1}{s}\right)^n}{1 - \left(\frac{1}{s}\right)^{n+1}} = \frac{s^n - 1}{s^n} \Big/ \frac{s^{n+1} - 1}{s^{n+1}} = \frac{s(s^n - 1)}{s^{n+1} - 1}$$

$$= \frac{s + s^2 + \ldots\ldots + s^n}{1 + s + s^2 + \ldots + s^n}$$

The derivation of the general formula given above is based on a consideration of the values of the solids in the expressed juice combined with the value of the quantity of water added in terms of residual juice. The same reasoning will equally appply if s be defined as the value of $r/(1 - r)$ where r is the factor of extraction.

As a corollary of the expressions now obtained the following tabulations of values may at once be written down.

I.

Solids in terms of solids in last mill juice (Mill 1) put equal to unity.

Mill 1 (Last in train). 1

Mill 1 (Penultimate mill). $1 + s$

Mill n (First in imbibition train) $1 + s + s^2 + \ldots + s^{n-1} = (s^n - 1)/(s - 1)$

Mill $n + 1$ (Dry crushing unit). $1 + s + s^2 + \ldots + s^n = (s^{n+1} - 1)/s - 1$

II.

Solids in terms of solids in secondary juice (mill n) put equal to unity.

Mill 1 (Last in train). $1/(1 + s + s^2 + \ldots + s^{n-1}) = (s - 1)/(s^n - 1)$

Mill 2 (Penultimate Mill). $(1 + s)/(1 + s + s^2 + \ldots + s^{n-1}) = (s^2 - 1)/(s^n - 1)$

Mill n (First in imbibition train). $1 = (s^n - 1)/(s^n - 1)$

Mill $n + 1$ (Dry Crushing Unit). $(1 + s + s^2 + \ldots + s^n)/(1 + s + s^2 + \ldots + s^{n-1}) = (s^{n+1} - 1)/(s^n - 1)$

III.

Solids in terms of solids in primary juice (mill $n + 1$) put equal to unity.

Mill 1. $1/(1 + s + s^2 + \ .\ .\ + s^n) = (s - 1)/(s^{n+1} - 1)$

Mill 2. $(1 + s)/(1 + s + s^2 + \ldots + s^n) = (s^2 - 1)/(s^{n+1} - 1)$

Mill n. $(1 + s + s^2 + \ldots + s^{n-1})/(1 + s + s^2 + \ldots + s^n) = (s^n - 1)/(s^{n+1} - 1)$

Mill $n + 1$. $1 = (s^{n+1} - 1)/(s^{n+1} - 1)$

IV.

Solids in the various juices expressed in terms of R.

Mill 1, $1/(1 + s + s^2 + \ .\ .\ .\ + s^2) = 1 - \dfrac{s + s^2 + \ .\ .\ .\ + s^n}{1 + s + s^2 + \ .\ . + s^n} = 1 - R$

Mill 2. $(1 + s)(1 - R)$

Mill n. $(1 + s + s^2 + \ .\ .\ .\ + s^{+n-1})\ (1 - R)$

$$= (1 + s + s^2 + \ .\ .\ .\ + s^{n-1})\left(1 - \frac{s + s^2 + \ .\ .\ .\ .\ + s^n}{1 + s + s^2 + \ .\ .\ .\ + s^n}\right)$$

$$= \frac{1 + s + s^2 + \ .\ .\ .\ + s^{n-1}}{1 + s + s^2 + \ .\ .\ .\ + s^n} = \frac{s + s^2 + \ .\ .\ + s^n}{s + s^2 + \ .\ .\ .\ + s^{n+1}} = \frac{R}{s}$$

V.

Extraction by each mill in terms of juice in primary bagasse.

Mill 1. $s/(1 + s + \ .\ .\ .\ + s^n) = s(s - 1)/(s^{n+1} - 1)$

Mill 2. $s^2/(1 + s + \ .\ .\ .\ + s^n) = s^2(s - 1)/(s^{n+1} - 1)$

Mill n. $s^n/(1 + s + \ .\ .\ .\ + s^n) = s^n(s - 1)/(s^{n+1} - 1)$

VI.

Extraction in terms of juice in primary bagasse at delivery from each mill.

Mill 1 $(s + s^2 + \ .\ . + s^n)/(1 + s + s^2 + \ .\ . + s^n) = s(s^n - 1)/(s^{n+1} - 1)$

Mill 2. $(s^2 + \ .\ . + s^n)/(1 + s + s^2 + \ldots + s^n) = s^2(s^{n-1} - 1)/(s^{n+1} - 1)$

Mill n. $s^n/(1 + s + s^2 + \ .\ .\ .\ + s^n) = s^n(s - 1)/(s^{n+1} - 1)$

From an inspection of these various expressions it follows :—

(1) That the solids in the juices extracted by the mills in an imbibition train vary from mill to mill with successive powers of s. If s is equal to unity, the increase is constant from mill to mill, if s is less than unity the increase from mill to mill will decrease in passing from mill 1 to mill n, the reverse happening when s is greater than unity.

(2) The same relation obtains as regards the extraction at each mill as is stated in I above for the solids.

(3) In what the writer has referred to as the ideal case, that is to say, when the value of m is 0·5, the value of s becomes $k = w/f$.

(4) When r has a value of less than 0·5 or equally where $s = r/(1 - r)$ has a value of less than unity, then the limiting value of R is s, and when r is equal to or greater than 0·5, and s is equal to or greater than unity, the limiting value of R is also unity. This follows from inspection of the value of R written in the form :

$$R = (s^{n+1} - s)/(s^{n+1} - 1)$$

for when s is less than unity, s^{n+1} becomes zero when n is great and the expression reduces to s.

Conversely if s is greater than unity s^{n+1} becomes infinity when n is great and the expression reduces to unity.

It follows then, that under what I term the ideal condition ($m = 0{\cdot}5$) a complete extraction can never be obtained with added water less in quantity than the fibre.

(5) Referring to the value of R in the form :

$$R = \frac{r[(1-r)^n - r^n]}{(1-r)^{n+1} - r^{n+1}}$$

it is apparent that the portion within brackets gives equal values for r and for $1-r$, i.e., the value for $r = 0{\cdot}4$ is the same as for $r = 0{\cdot}6$.

Let $s = r/(1-r)$ and $s_1 = r_1/(1-r_1)$ where $r = 1 - r_1$,

Then $s = (1-r_1)/r_1$, that is to say s and s_1 are reciprocals, or when this condition obtains the ratio R/R_1 is constant for all values of n.

(6) The same result can be obtained by simplifying the expression :—

$$\frac{\frac{1}{s} + \left(\frac{1}{s}\right)^2 + \ldots + \left(\frac{1}{s}\right)^n}{1 + \frac{1}{s} + \left(\frac{1}{s}\right)^2 + \ldots + \left(\frac{1}{s}\right)^n} = \frac{\frac{1}{s}\left[\left(\frac{1}{s}\right)^n - 1\right]}{\left(\frac{1}{s}\right)^{n+1} - 1}$$

The numerator in the expression on the right reduces to $\dfrac{1-s^n}{s^{n+1}}$.

The denominator in the expression on the right reduces to : $\dfrac{1-s^{n+1}}{s^{n+1}}$.

The whole expression therefore reduces to $\dfrac{s^n - 1}{s^{n+1} - 1}$.

But $$\frac{s + s^2 + \ldots + s^n}{1 + s + s^2 + \ldots + s^n} = \frac{s^{n+1} - s}{s^{n+1} - 1}$$

Whence $$\frac{s + s^2 + \ldots + s^n}{1 + s + s^2 + \ldots + s^n} = \frac{s(s_1 + s_1^2 + \ldots + s_1^n)}{1 + s_1 + s_1^2 + \ldots + s_1^n}$$

where $s_1 = 1/s$.

New Method of Evaporator Tube Cleaning.

Interesting results are reported from Queensland with the new method there introduced of cleaning evaporator tubes so as to free them effectively from scale. At one of the mills, the chemist states : "We have been successful with this method of cleaning effect tubes, for from the beginning of the 1928 season up to the end of 1930 we have crushed 653,391 tons of cane without any scraping whatever of the tubes, and at the present time they are in splendid order. As a matter of fact, effect cleaning now causes us the least concern of any work in the factory."

The method consists in boiling out at the week-end with a preparation called "Algaloid," which has a remarkable effect in softening the scale. It is an apparently inert, vegetable extract, but the manner in which it produces the results which are claimed for it does not appear to be clear. Its effect combined with the boiling action is suggested to be mechanical rather than chemical. That it is efficient, however, and transforms the scale into a soft, slimy mass without having any action on the tubes, appears to be proved. Following is a report on the manner of use by one of the Queensland mill chemists, showing also the economy of this new method of working :—

Liquor pumped out of the "pots" at the end of the week is immediately followed by an 0·05 per cent. solution of "Algaloid," which is boiled for half-an-hour, left standing in the pots until Sunday night, given a further two hours' boiling, and lastly run off into the storage tank. There it is strength-

ened up weekly by the addition of 10 lbs. of " Algaloid " to 6000 gallons of the solution.

Stress is laid on the importance of boiling up well with the preparation immediately the syrup leaves the evaporator. There should be no delay. As for the expenses of the treatment, below are figures comparing the costs of the new method with the old method of scraping. The only two items considered are the wages of the operators, as the boiling on Saturday is done as fires are being drawn, and on Sunday night, as soon as sufficient steam is again available.

New Method.	£	s.	d.
"Algaloid"	1	12	2
Quadman, 3 hours, double time	0	16	0
2 tons of wood	1	16	0
	£4	4	2

Old Method.	£	s.	d.
Sunday scraping, 9 men 8 hours	19	11	8
Candles, waste and caustic soda	0	3	6
Fitter, repairing brushes, etc., 4 hours	0	11	11
Brushes	0	3	0
	£20	10	1

That is a saving of £16. 5s. 11d. per week. Each of the pots contains 2700 tubes; and the work of cleaning these by hand besides being laborious and unpleasant requires constant supervision in case tubes are missed or only half cleaned. With the new method, the whole of the calandria is under treatment. There is no wear-and-tear on the tubes, scrapers and brushes are eliminated, and the doors once closed do not require to be opened again for the remainder of the season.

These results seem to be given some confirmation by reports from factories in the West Indies and in South America where an apparently similar preparation, or perhaps an identical one under another name, is being used largely. It is shipped in drums in the form of a liquid costing about 10s. per gallon delivered to the estate.

One user describes the initial test made at his factory as follows : " Each vessel of the triple was filled with water to cover the tops of the tubes, the extract added at the rate of 1 gallon per 1000 sq. ft. of heating surface, and boiling carried on at atmospheric pressure for four hours. After the vessels had cooled sufficiently for the men to get inside, it was found that the scale was like mud, and readily removable with wire brushes, leaving the metal quite clean."

In the case of this triple of 6000 sq. ft., the total cost of the preparation used was $15 ; whereas that of the " old style " system as it is termed of cleaning, using soda ash and muriatic acid, allowing for the re-use of the liquids after strengthening up, would not be less than $80. Other users state that they are able now by weekly treatments to maintain their tubes in clean condition more economically than by the use of usual chemicals or scrapers. Generally the last vessel is given a double dose. After bringing up to strength again the liquid can be used several times, so that its cost in application works out much more economically than is indicated above.

U.S.A. Sugar Supply Sources.—Sources of the United States supply of sugar are as follows, according to recently published statistics : Cuba, 51·88 ; Hawaii, 13·34 ; Philippines, 10·40 ; Porto Rico, 6·61 ; domestic cane and beet, 17·44 ; and " miscellaneous," 0·33 per cent.

Recent Work in Cane Agriculture.

A MOSAIC VIRUS OF GRASSES, NOT VIRULENT TO SUGAR CANE. **H. H. Storey.** *Annals of Applied Biology*, Vol. XVI, No. 4, November, 1929.

Leaf mottling typical of mosaic disease is commonly found in a number of wild grasses growing in the vicinity of diseased cane; and it has been generally supposed that such grasses act as reservoirs from which the virus might be carried to sugar cane. This supposition has been confirmed by transmission experiments by various authors. But evidence has been met with in the Transvaal, which shows that this is not always the case. The author met with a mosaic there, indistinguishable from that in Natal, which affected maize and Sorghum where no diseased canes were known to exist, and experiments seem to indicate that this mosaic is incapable of producing any disease effect on sugar cane. The present paper deals with the experiments on which this conclusion is based and confirmed : in this paper the new mosaic is termed Transvaal, as contrasted with ordinary cane mosaic of Natal and other countries, which is termed Natal mosaic.

Transvaal mosaic was first observed in 1924 on a wild grass named *Sorghum arundinaceum*, collected near to and planted in the Groenkloof Experiment Station near Pretoria. A mosaic was subsequently found in the Rustenburg and Waterberg districts of the Transvaal, on cultivated Sorghums and maize, while a number of small plots of sugar canes of known susceptibility showed no trace of the disease. The identity of these Transvaal mosaics has not been proved by the author, although there is no reason to suppose them different ; but the experiments to be described were all carried out with the mosaic from Groenkloof. The Transvaal mosaic resembles that on the Natal canes to such an extent that no visible character has been found by which they may be separated.

Experiment I.—To determine whether the Transvaal mosaic can be transmitted by Aphis maidis. Conducted in an insect-proof greenhouse, by the glass-tube leaf cage method, on maize. The sources of infection were diseased maize, cultivated Sorghum and *Sorghum arundinaceum* in the Transvaal, from which the Aphides were collected. In another case non-infective aphides were used from cultures on healthy plants subsequently fed for a time on diseased *Sorghum arundinaceum*. The mosaic appeared on the maize plants in 8 to 30 days, and 35 of the 65 maize plants gave positive results, while none appeared on an equal number of controls. Transvaal mosaic was thus successfully transmitted to maize by aphides collected on diseased maize, cultivated Sorghum and *Sorghum arundinaceum* ; and by aphides pıevicusly non-infective, fed for a period on diseased *Sorghum arundinaceum.*

Experiment 2.—To demonstrate the transmission of Natal mosaic to sugar cane and maize. Conducted in large cages with glass roofs and wire gauze sides, covering an area of 8 ft. square. Fourteen varieties of cane were planted with maize seedlings between. The sources of infection were POJ 213, Rose Bamboo, several cane varieties, *Setaria sulcata* (in two experiments), and *Sorghum arundinaceum*, all diseased specimens being collected in the Natal cane area. There were six experiments during the years 1925, 1926 and 1927. And none of these experiments failed to give some positive infections of sugar cane. The aphides used were reared upon healthy Sorghum seedlings, and were all the progeny of one original non-infective culture ; at intervals samples of the aphides were removed from the cultures and tested for infective power, and all failed to infect cane or maize. To test the original freedom from mosaic of the cane plants, portions of all canes used to provide the sets were grown

in an adjacent cage, usually cut from the top and treated similarly, but without diseased plants or aphides. None of the controls developed mosaic. (According to the Table the maize seedlings were also infected).

Experiment 3.—Designed to transmit the Transvaal mosaic to sugar cane, maize and Sorghum arundinaceum. Two experiments were performed in a similar manner to the last experiment, using the same strain of aphides. The source of infection was diseased *Sorghum arundinaceum* transplanted from Pretoria. In the two experiments all of the 100 cane plants, of varieties known to be susceptible to Natal virus, remained free from all signs of mosaic, while maize seedlings and *Sorghum arundinaccum* were infected. Aphides were observed feeding on many cane plants in one experiment and on all in the other.

Experiment 4.—A field experiment with Transvaal mosaic at Prinshof Experiment Station near Pretoria. Five susceptible cane varieties were planted alongside of mosaic diseased *Sorghum arundinaceum* from Groenkloof, and on the adjacent land plots of maize, grain Sorghum and sweet Sorghum were sown. These latter during the following months developed a large proportion of mosaic, but the cane plants remained free from symptoms, as well as the two following crops of ratoons, still alongside the ratoons from the diseased Sorghum roots. Many colonies of *Aphis maidis* were seen on the diseased *Sorghum arundinaceum* during each season.

Mayaguez 3, 7, and 42, Three Cane Varieties Immune to Mosaic. **R. L. Davis.** Agricultural Notes, Experiment Station Mayaguez. No. 52, December, 1930.

These seedlings are crosses between POJ 2725 and SC 12 (4). None of them have the objectionable early arrowing of POJ 2725, and several thousand stools have been grown for five years without showing a single case of mosaic. Mayaguez 7 and 42 are more drought resistant that SC 12 (4), and showed satisfactory germination under droughty conditions where BH 10 (12) failed. All three show a habit of growth between those of POJ 2725 and BH 10 (12); they will therefore close in more quickly than the latter. They appear to be of satisfactory thickness, and are less erect than POJ 2728 and therefore less liable to uprooting in violent winds. Handmill analyses from samples collected from rows adjacent to POJ 2725, 2878, and BH 10 (12) indicate that their sugar content will be equal to the standard cane varieties now being grown in Porto Rico. Small plots compare favourably in tonnage with POJ 2725 and 2878. Larger scale tests are in progress. These analyses and tonnage results are briefly shown in Tables.

The resistance to mosaic, germination, thickness, and good stooling power of these seedlings justify their extensive trial in Porto Rico ; and it is suggested that planters in different tracts should plant them in alternate rows with the varieties best suited to the tract. Then follow brief descriptions of the new varieties, for the purpose of readily identifying them, which are here reproduced.

Mayaguez 3 is a long-jointed cane, cinnamon or rusty coloured towards maturity. It is conspicuous for fine striations or markings similar to those on BH 10 (12). Buds are long and pointed. Growth is spreading during the first four months, later becoming quite erect. Leaf sheaths hairy and leaves shed very freely. No arrows have been observed in primavera and gran cultura plantings at Mayaguez. Gran cultura ratoons of M 3 have arrowed sparingly at Anasco.

Mayaguez 7 has joints of medium length, somewhat longer than those of BH 10 (12). The colour is yellowish green with a maroon red flush. Striations are less conspicuous than those of M 3. Buds are long and pointed. Growth is very erect during the first four months, and spreading towards maturity. Leaf sheaths are hairy but the leaves shed very freely. Leaves are broad and recurved. This variety arrows from 4 to 6 weeks later than POJ 2725. Early March primavera plantings at Mayaguez have not arrowed, and primavera planted in February, 1930 at Anasco show no signs of arrows at present (December).

Mayaguez 42 is a cane with very long joints. Its colour is greenish yellow, with a purple flush on the upper part of each internode. Striations are present but not conspicuous. Buds are round and confined below the growth ring. Growth is semi-erect at first and spreading towards maturity. Leaf sheaths are almost entirely free from hairs. The leaves are broad, dark green and erect. No arrows or tapering tops have been observed in primavera or gran cultura in plantings at Mayaguez.

NOTES ON GUMMING DISEASE OF THE SUGAR CANE. **J. L. Illingworth.** 1930.

This paper consists of three sections : (1) General notes on gumming disease, (2) Work done jointly with F. H. S. WARNEFORD on the 1928-1929 cane crop in Antigua, and (3) Work by the author alone on the young canes of the 1929-1930 crop.

I.—Gumming disease was first reported from Brazil in 1863, and was discovered in Australia in 1893 by COBB, who isolated the causal organism and named it *Bacterium vascularum*. Since then it has appeared in Mauritius, Fiji, Colombia, Porto Rico, the Leeward Islands and St. Lucia. The symptoms are to be found in the leaves as thin, translucent stripes and in the freshly cut stems as a yellowish gum (the details of these symptoms having often been described). Its effects on the plant are : failure to germinate, death of young shoots, drying or stunting of old stalks, failure to ratoon, rapid deterioration after cutting, lowering of juice purity and difficulty in crystallization. The bacteria usually live in the vascular bundles of the leaf and stem, but in severe cases also invade the ground tissue of the stem and form cavities filled with gum (as in Bourbon).

As to its dissemination, this was worked out by D. S. NORTH in an intensive study of the disease, in New South Wales, and the results were published in 1927. From this study it appears that the spread may be caused by planting diseased cuttings, also by the knives of the cane cutters, and sometimes by flies over long distances ; but, as a class, leaf sucking insects are unimportant. When, however, the disease is once in a plantation and the leaves are affected, the striking of these against one another by the serrated leaf edges causes minute abrasions, and the exuding gum is rapidly spread from plant to plant. Thus wet, windy weather is generally followed by a great increase of leaf infection.

Many observations have been made as to the varying susceptibility of different kinds of cane to gumming ; and it has been fortunately established that many of the newest and best seedlings are resistant almost to the point of immunity. In Porto Rico, M. T. COOK is quoted as giving Bourbon 100 per cent. infection, and Ba 10(12) less than 1 per cent., and the following, more or less in order, between these two extremes : B 6308, Transparent, Ba 6032, D 109, Ba 11569, D 117, SC 12(4), the first two being given 90 per cent. and the last two 1-10 per cent. The disease was first noted in the Leeward Islands by J. MATZ of Portó Rico in St. Kitts in 1925, and by S. F. ASHBY in Antigua

and Dominica in 1929. (It would appear that its introduction to, or any spread in Antigua is comparatively recent, for MATZ did not find it in 1925, whereas in 1929 it was present throughout the cane fields of the island).

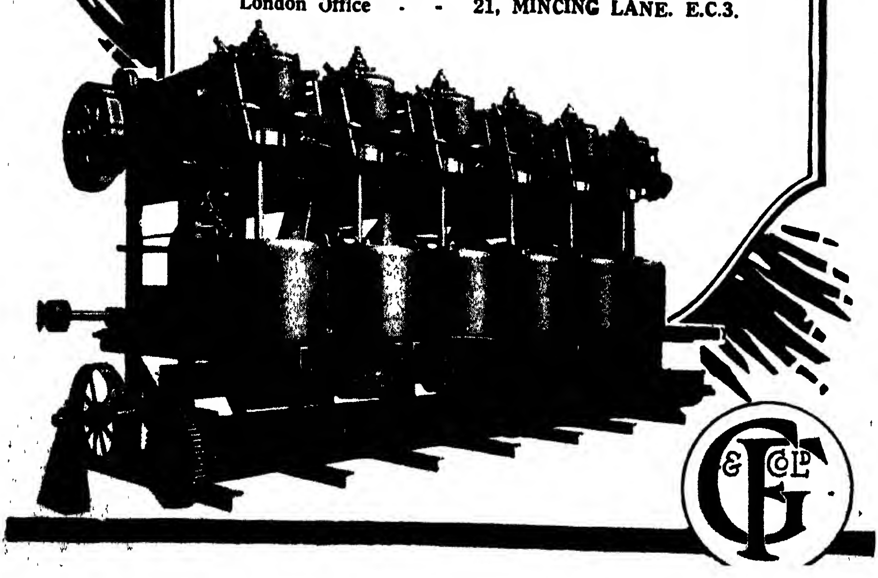
II.—In Antigua Ba 11569 was (in 1929) the dominant cane, on account of its excellent germination, rapid growth, and early maturing ; and was especially used for supplying vacancies in the young fields. For this reason, this cane is found in most cane fields to a greater or less extent throughout the island. It was observed, however, to be susceptible to gumming, and hence formed a ready means of testing the susceptibility of the other kinds in contact with it. As a result, the cane varieties grown were divided into four classes of susceptibility, as follows : (1) Highly resistant, with very occasional small leaf markings, when in contact with heavily infected Ba 11569, but no stem symptoms: BH 10(12), B 4507, B 6308, B 4596, SC 12(4), B 147 and B 471. (2) Semi-resistant, distinctly susceptible to leaf infection but resistant to stem infection : Ba 6032, Hill Seedling and White Transparent. (3) Susceptible, 100 per cent. infection throughout the island, percentage of stem infection fairly high but never intense, Ba 11569. (4) Very susceptible, intense stem infection : gum exudes from cut surfaces in such large quantities as to form a general smear : Bourbon.

Certain observations are then recorded which would seem to indicate that the spread of the disease through Ba 11569 occurred only by leaf transmission. There was, moreover, no falling off in germination, nor were any deaths of whole canes or tops traceable to gumming, and the general qualities of the variety remained unimpaired.

In studying stem infection in Ba 11569, the method adopted was to prepare by cuts five surfaces in different parts of each cane examined : through the top joint, a quarter of the way down the stem, half way down, three-quarters, and through the second joint from the base of the cane. The pieces were taken to the laboratory and incubated for 18 to 20 hours in a moist, warm chamber. The upper surfaces of the pieces were then examined for gum, usually counting the numbers of globules formed by exudation from the vessels in each piece. A number of fields were chosen, in different estates, on heavy clay, light volcanic and light calcareous soils, and at different stages of growth, plant canes, and first and second ratoons : 25 Ba 11569 canes were picked out in each case, at random, but from different stools. By noting the presence of gum, figures were obtained for dissemination ; and by counting the number of globules in each section an idea was formed of the intensity of infection.

The average percentage infection in plant canes (5 fields) is given for each part of the plant from above downwards as : 4, 19, 25, 48 and 19. These figures show a curious arrangement of gumming symptoms : the percentage infection was greatest three quarters of the way down the stem, and fell below that towards the base of the stem. And an interesting deduction was drawn from this and other facts. This part of the cane, three-quarters of the way down, proved to be the region of leaf insertion when the hurricane of September 12th, 1928, smote the island, and of course presented exactly the conditions formulated by North for the rapid transmission of the disease from leaf to leaf. And it is pointed out also that the subsequent weakening of the roots and lowered vitality of the plants, together with the moist conditions caused by water lodging in the leaf sheaths, would be ideal for the passage of the bacteria in the vessels from the leaf to the stem.

Stem infection of Ba 11569 is usually very light, only a few globules being found on the cut surfaces examined, and in no case approaching to a "smear"



of gum. The average number of vascular bundles showing exudation in the successive sections were : 1·0, 1·2, 2·0, 2·0, and 1·8 : the intensity of infection thus revealed showed approximately the same distribution down the stem as the percentage infection. The plant canes and first ratoons showed practically equal stem infection, but there was a marked reduction in the second ratoons, not however accompanied by any marked diminution in leaf symptoms. The percentages of infection in second ratoons are shown by the following average figures ; 0·0, 1·0, 1·0, 5·0, 6·0, 10·0, which show a very marked reduction on plant canes given above.

III.—In the third section of this paper, the young crops of 1929 were submitted to an examination as to the incidence and intensity of infection by gumming in Ba 11569.

Young ratoons.—The fairly resistant nature of this variety under normal Antigua conditions has been already noted, as well as the extremely heavy infection during the hurricane in the previous year's crop. One question which naturally arose was whether this variety would be able to throw off the infection on a return to more normal conditions, or had become unable to do so through a breaking down of its resistance. In July, first and second ratoons were examined at four places, and showed no typical leaf markings. Frequent incubations of the cane pieces also gave no signs of gumming in the stems. There was a general development of leaf symptoms in August, September and the first half of October, in fields whose growth was sufficient to give general leaf contact, and especially where the weather had been wet and squally. Incubations of cut pieces of cane, carried out as before, showed that gumming of the stems followed in due course : three sets of figures are reported as to the incidence of gummosis. In a field of first ratoons, the analysis after incubation worked out on August 28th as : 0·0, 0·0, 0·4, 0·8, 0·4 per cent., the outermost and therefore most heavily infected leaves being inserted at the region of maximum infection. In older ratoons, at about the same time, the figures were : 0, 4, 8, 10, 12, 12, and on October 18th : 0, 4, 10, 16, 16 per cent.

The author sums up : " With the doubtful exception of the plot at the Experiment Station (from which the last two sets of figures were taken), which as plant cane carried the heaviest observed stem infection, there is no evidence of infection entering the young ratoon shoots from the previously infected root stocks "

Young plant canes.—Observations of a similar nature to those on ratoons were recorded, leading to the same general results. The development of leaf symptoms followed the same course, the general incidence being delayed until leaf contacts became numerous. On three fields examined leaf infection became general at about the middle of August, and by the second week in October infected leaves were found on every stool. In the second week of October, gumming was also shown in two out of four estates examined, the figures being : 0, 16, 12, 8, 0 ; and 0, 4, 4, 4, 4 per cent. No gumming was met with on the other two estates.

Natural infection through Ba 11569 cuttings.—An experiment was made of growing canes from cuttings showing globules, and others as controls which showed none. There was no difference in the rate of germination of the two sets of cuttings, but the average growth of the young plants from the diseased cuttings was one-seventh less than the controls. The experiment, however, was made with canes more heavily diseased than is usual throughout the island, and it is considered that the numbers employed in the experiment were insufficient for dogmatism.

THE TOXIC ACTION OF MAGNESIA ON SUGAR CANE. **M. Bird.** *Agricultural Journal of British Guiana.* Vol. III, 3. September, 1930.

In a recent notice of the prevalence of root disease in the cane of British Guiana, attention was drawn to a suggestion by the Director of Agriculture that "an unduly high magnesium ratio to calcium in the soil would appear to be a contributory cause."[1] The present paper gives some details in support of this suggestion, as follows.

For many years the cane plants in British Guiana have suffered from what appears to be a form of root disease arising from an insanitary condition of the soil; and in 1925 this became so threatening in certain parts as to draw serious attention; but the only definite symptoms appeared to be the withering and death of canes and stools. No specific organisms could be detected, but on analysis of the canes the author found an unusual quantity of magnesia, especially in proportion to the lime present. In 1929 he visited an estate where the disease was acute, and found the proportion of magnesia to lime high in both canes and soil, in both cases there being three times as much magnesia as lime. In the next year, he made the experiment of dosing four healthy cane stools with 8 oz. of magnesium sulphate each: the dose was applied on May 4th, and on revisiting the field on August 15th he found all four stools dead. On making two analyses of the dead canes, he found the ratio, CaO : MgO, to be 15 : 24 and 24 : 84; and similar results were obtained from the ash analyses of the canes. The author remarks that the rainfall during the period of experiment had been heavy (41·49 in.), which should have kept the magnesium salt in a dilute solution; and that this excess of magnesia over lime appeared to be prevalent throughout the sugar belt of British Guiana.

An attempt was then made to locate the layer of soil in which the magnesia was present. Four experiments were made on two estates, two in each, of digging out 6 in. layers of soil down to a depth of three feet, and analysing them. On one estate there was an excess of magnesia over lime, in one experiment in the third layer down and in the other in the sixth, and several canes were dead. Two of these dead canes were analysed, and gave ratios, CaO : MgO, 14 ; 86, and 13 : 84. On the other estate, there was only one case where an excess of magnesia occurred, namely in the fourth layer, but no dead canes were present.

Remedial measures would be difficult, because of the impossibility of leaching out the magnesia from such heavy clays. Digging in organic matter and working the soil would improve the permeability; and in cases where magnesia is in excess, lime should be added, in fact, in all cases where lime is not present to the extent of double the magnesia. If applied in the form of tempered lime or hydrate, it would be more effective, in that much of the magnesia would be precipitated in an insoluble form.

The author concludes this short paper as follows: "To summarize, if the small quantity of magnesia, in the apparently harmless epsom salt, can cause death, then the magnesia diffused throughout these alluvial lands, to which attention is drawn, must be held accountable for innumerable disappointing yields from crops which in their early growth gave promise of excellent returns."

INSECT PESTS OF THE SUGAR CANE. V. THE MOTH BORER—ITS CONTROL. **T. E. Holloway,** Bureau of Entomology, United States Department of Entomology. *Facts about Sugar,* Vol. 26, No. 2. February, 1931.

The paper commences: "As with snakes in Ireland, there is none," and concludes: "Control of moth borer is, in most countries, a difficult prob-

[1] *I.S.J.*, 1931, 70.

lem : there is no doubt about that. The prospect is, however, continually brightening, as we find out what is impracticable and what can be done." The author, presumably, is most fully acquainted with the actual conditions in Louisiana, and some of the paragraphs appear to refer only to that country. This may account for a pessimism unusual among entomologists, for there appear to be special difficulties in the control of the moth-borer in Louisiana. But it is, none the less, very useful to have the following broad survey by a competent expert, without any of the illusions so common; here and elsewhere, among enthusiasts.

Cleaning up methods are only applicable in general to countries with a winter, and a close season in the sugar cane crop. Some entomologists recommend planting large areas at the same time, as is done in Peru with very desirable results. But generally much refuse is left about in a rather inexcusable manner. This would also apply to wild grasses in which the pest might harbour, and clover is suggested as taking their place. Corn as a food plant is a natural reservoir for the borer, although it is not grown in some countries.

Deep planting is recommended in the tropics, as this would prevent the moths from emerging ; but in Louisiana the earth is scraped away, and moths continue to come out for some months ; and it might be worth while to delay the scraping a bit if it were possible.

Selection of seed has an additional advantage of requiring less to be sown, especially if the set is obtained from a field with a minimum of borer in it ; but it is important that the selection work should be done where the canes are cut, and never in the field to be planted.

Treatment of the sets is done by soaking the sets in water : for 72 hours in cold water and for 20 minutes in water at 50°C.; but the latter is less applicable to Louisiana, for the buds on windrowed canes are specially liable to be injured. Water treatment, moreover, requires elaborate equipment, and tends to delay the routine operations on the estate and is not therefore popular.

Ratoons.— These should be cut low down, for high stalk pieces left form an excellent breeding ground for borers, besides a waste of sugar in the crop. But it is difficult to get the labourers to stoop when tired, and a mechanical cutter is needed. In Castnia, the larvae descend into the roots when they feel the cutters approaching, and SKINNER is quoted as saying that many grubs are found cut through in the field after reaping the canes.

Collecting dead hearts and larvae.—Pulling out the former is tiresome work, but is sometimes of advantage on a limited scale, especially in fields where the borer spreads from heavily infested centres. Its effect on parasites must however be borne in mind. Collecting the grubs is regularly practised in only one country, namely, British Guiana, and has lately extended to Trinidad and Java. In British Guiana boys go through a field, and as soon as they have done so begin again ; and millions are killed in this way : they are paid for the number collected. But in spite of this work, there is still much damage done by borers in that country. For the destruction of Castnia, fields are flooded for long periods, but this method is practically impossible in most countries and its effect on the soil is very undesirable.

Collecting adult moths and eggs.—The catching of Castnia is comparatively simple, as it is brightly coloured and flies by day ; but the moth borer is dull-coloured and flies by night. It is only recommended by KANNAN in India, by making refuge heaps of trash ; but when tried in Louisiana it was found that there were so many other hiding places that the trash heaps do not appear to

offer any attraction to the moths, probably because of difference in species. Collecting eggs is now only practised in British Guiana, and usually the cost of labour would be too great.

Burning the trash is recommended by entomologists in some countries, but not in others : borers are often protected from the fire, whereas the parasites are not. Leaving the trash unburnt has been tried in Porto Rico and Louisiana, and is now being tried in Cuba, and in all three has resulted in a reduction of the numbers of borers. In West Mexico, on the other hand, the climate is such that the trash decomposes very slowly, which necessitates its being burnt. In Cuba the parasite observed was Lixophaga, in Louisiana Diatraea, and in Porto Rico both. In British Guiana it is believed that many beneficial insects are destroyed in burning.

The propagation of parasites.—So far this has only been tried on a large scale with *Trichogramma minutum*. The eggs obtained from Diatraea or the grain moth are dusted on to paste covered cards : then the parasites are let in, and attack the eggs : this is repeated until a large number of eggs are parasitized, when the cards are distributed to the fields. Because of difficulties owing to weather, this method has not as yet proved a practical success.[1]

The introduction of parasites from other countries is yet in its infancy. Probably the only parasite which has had a fair trial is Lixophaga, brought from Cuba to Louisiana. It proved itself a very effective parasite on the borer itself but is now rarely found, probably because of the winters; but this has not as yet been determined.

Trap crops.—Planting several rows of corn along the edges of fields has been tried, the corn plants being destroyed when half grown and presumably full of borer grubs. The difficulty here is rather psychological than entomological ; such crops are usually neglected and stunted, and if they grow well the planters tend to keep them till the roasting stage, and if so, damage is done before they are destroyed. Where, as in Louisiana, corn fields are interspersed with cane fields, the planters do not approve of their destruction. Sorghum has been suggested as the trap crop, but the author found that Diatraea is little attracted to it.

Light traps and baits.—The adult moth borer does not appear to be attracted by light,[2] or by sweet or flavoured substances. Borers in the cane can rarely be reached by poisons such as lead arsenate or sodium fluosilicate, and experiments with dusting such substances in Cuba and Louisiana have not met with great success.

Resistant varieties.—There appears to be some chance here, for some POJ's are preferred to others by the borer. And the conditions of growth may also have some influence; for instance, a poor field of native canes had every stalk attacked, while in a good field of POJ the attack was not noticeable, although the actual numbers of borers were probably about the same.

C. A. B.

TARIFF CHANGES.—The French Chamber of Deputies has passed a bill raising the import duties on foreign sugars—over 98° from Frs. 140 to Frs. 170 per 100 kg. ; 98° and under from Frs. 136·50 to Frs. 165·75. In Hungary the import duties on raw and white sugar has been raised from Kr. 36 to Kr. 38·8 per 100 kg., the consumption tax apparently remaining at Kr. 35.

1 This appears to refer to Louisiana. For an account of this experiment under favourable weather conditions, see *I.S.J.*, 1930, 623.

2 In Antigua, some forty years ago, an adult Diatraea moth obtained by breeding, was confined in a small paper tube by the writer. When the tube was turned towards the light, the little moth instantly turned its back towards it, and reversed itself as often as the tube was reversed.

The Vallez Filter in Sugar Refining.

By JAMES McCRONE.

In sugar refining the rapidity and efficiency of filtration are of the greatest importance to the economy of the whole process. The benefits of improved filtering are increased daily tonnage treated, reduced load on the char or other refining carbon and reduced final molasses allowing of increased recovery of sugar.

The Vallez Filter is designed to overcome the filtering troubles which have all along afflicted refiners. Prominent among these are : the imperfect removal of haze from liquors allowing impurities to go to the charcoal cisterns with harmful effect on the efficiency and cost of decolorizing ; the large amount of water necessary to exhaust the filter cake of sucrose, calling for a great amount of evaporation ; the high labour cost for operating older types of filter, cleaning cloths, etc. ; and the high cost of filter cloths.

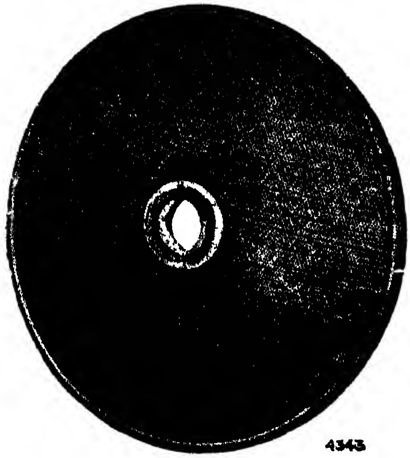


FIG. 1.

The outstanding feature of the Vallez design is the rotating element which entirely avoids the tapering formation of filter-cake inevitable in stationary types. For refinery work the element is built up of forty leaves mounted on a hollow shaft which serves as a common header for leading the filtrate out of the cast-iron casing. Fig. 1 shows a view of one of the leaves, in which two discs of woven wire cloth are backed by perforated plates, the latter being separated internally by a coarse mesh screen of heavy gauge to form the drainage paths to ports in the hub. The leaves form an assembly which is mounted by means of flanged couplings and shaft extensions in an axially split casing, as shown in Fig. 2. The leaf element is rotated slowly by worm driving gear, the power required being quite nominal as only shaft friction has to be overcome, thus all parts of the leaves are brought under the action of the pressure spray device for dislodging exhausted cakes, dispensing with any need to open up the casing. Quickly-opened inspection doors are provided for sampling cake and verifying that leaves are clean, etc. The liquor and hot water connections are made on a manifold pipe communicating through four inlets on the casing, which ensure even distribution and avoid local turbulence.

The usual cycle of operations comprises :—

1st.—Pre-coating leaves with clean filter-aid by circulating a suspension of filter-cel or Hyflo-Super-cel in previously filtered liquor for a few minutes until the discharge runs bright.

2nd.—The impure liquor is now fed to the filter carrying a small proportion of filter-aid in suspension, which builds up along with the separated impurities to maintain the porosity of the cake. Filtering is continued until pressure is up to the maximum working pressure of 40 lbs. per square inch and the flow has diminished.

3rd.—Filtration is stopped by closing the feed valve only and the unfiltered liquor is drained back, at the same time maintaining a few lbs. pressure in the casing by means of compressed air admitted at the top.

4th.—Hot water is pumped into the casing against the air pressure. This forces through the even homogeneous cake and quickly displaces all the sucrose with minimum dilution.

5th—Part of the remaining water in the casing is drained back and the pressure spray turned on, also air agitation in the bottom trough. In a few minutes the leaves are thoroughly cleansed and ready for a new cycle.

In the issue of this Journal for January, 1928, page 48, a description is given of another patented design, having the leaves set radially for facilitating removal. So far this type has not been tried out in Britain.

The adoption of the Vallez Rotary Leaf Filter by the leading refiners and a number of the beet sugar houses in the U.S.A. proved to be a tremendous advance in filtering. Now similar success is being realized in day-to-day operation of British-built Vallez Filters in the British refining industry, the equipment being supplied by the Mirrlees Watson Co., Ltd., Glasgow, the Licensees for manufacture and sale in Great Britain and the Colonies. The first installation in the United Kingdom was put to work in the Berryyards Refinery of the Westburn Sugar Refineries Ltd., Greenock, about two years

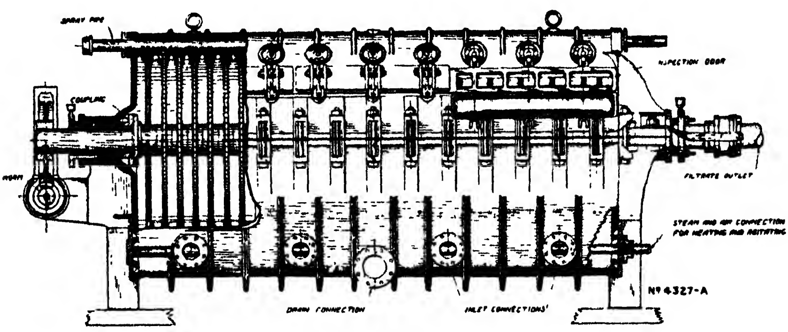


FIG. 2.

ago. This development reflects the enterprising spirit shown by the refinery management, who selected the Vallez machine after a careful study of all the latest filtering methods. From the subsequent expansion of the firm's operations there can be no doubt that the high claims made for the Vallez Filter are justified, particularly in regard to greatly increased tonnage of sugar, reduction in labour cost, and reduction of the work imposed on the char house. In spite of the grave difficulties confronting industry, 1930 has been for the Westburn Sugar Refineries Limited, a year of record production and increased earnings, the rightful reward of a courageous policy of plant modernization.

Following upon the success of the installation at Greenock, the well-known Liverpool refining firm, Messrs. Macfie & Sons, Ltd., decided to re-equip their filter station with Vallez machines, and the work of putting the first units into commission is now in progress. One of these is illustrated in Fig. 3.

The particular advantages of the patent design of the Vallez Filter fall into three groups, attributable to (1) rotation of leaves (2) metal wire cloths and (3) closed operation. The extent of their fulfilment in British experience should compel the attention of all engaged in this and similar industries.

(1) Rotation of leaves in the Vallez design ensures :—

(*a*) Uniform thickness of cake. This is fully realised in practice.

(*b*) Homogeneous cake structure : likewise evident from numerous samples examined.

(*c*) Consistent brilliancy of filtrate : a high degree of clarity has been obtained month after month of steady working.

(*d*) Every part of filtering area is brought under the action of the cleansing jets.

(*e*) Ease and economy of sweetening-off : from a filter which has treated 100 tons sugar, it is not uncommon to exhaust cake completely with production of only 200 gallons sweet-water.

(*f*) Quick sweetening-off, avoiding delays causing inversion : this operation usually lasts about 5 minutes and never exceeds 10 minutes.

(*g*) Sweetening-off cake in place in the filter without the need for a separate press for sweetening-off (double pressing).

(2) Use of metal wire cloths has these results :—

(*a*) Maximum filtering efficiency of kieselguhr or paper pulp, as filter-aid is realized in quick pre-coating, fast filtration and sustained brilliancy of filtrate over a long cycle. One filter working four cycles in 20 hours has treated fully 200 tons sugar : it is possible to work one cycle only of that duration with, of course, a lesser output.

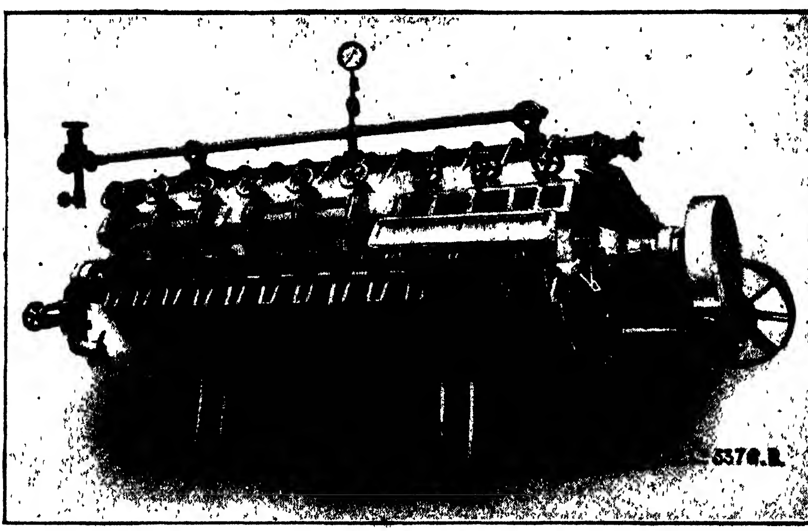


FIG. 3.

(*b*) Elimination of heavy daily expense of washing and maintenance of cloths, bags, etc., and the labour of removing these from and fitting to the presses.

(*c*) Long life of leaf dressings : phosphor bronze wire cloths give about three years' service before requiring replacement. Monel metal cloths have rather longer life.

(*d*) Ease of thorough cleaning of filter : de-sugared cake is easily dislodged from metallic cloths on release of pressure, by action of the water-jets.

(3) Closed operation means :—

(*a*) Minimum loss of heat by radiation and vaporization.

(*b*) Minimum requirement of labour: attendants' work is manipulation of valves: in a four-filter plant, two men per shift are sufficient to mix the filter-aid and operate the whole station.

(*c*) A clean filter station, free from scattered sticky liquor mud, water, etc.—can be kept as tidy as a turbine-room.

Investigations that have been made into filtering costs show that the savings resulting from the use of Vallez Filters are very considerable. An interesting analysis appeared in the June, 1930, issue of this Journal, relating to experience at Pennsylvania Sugar Co., Philadelphia, which clearly indicates that big economy is possible by discontinuing the use of filters requiring textile cloths and manual labour.

Notes on the Economical Production of Sugar.[1]

By Dr. WILLIAM E. CROSS.

(*Continued from page* 110.)

The Work in the Factory.

Vigilance in the factory.—In order that sugar may be produced economically, the most thorough vigilance is necessary in all sections of the factory during all the twenty-four hours of the working day, as when this vigilance is lacking or insufficient, the workmen, either through ignorance, indifference or laziness, frequently do their work badly or make serious mistakes. Especially during the night shift is this vigilance necessary,—and it may be pointed out that it is just during these hours, when bad work is most likely, that many factories are left in charge of very subordinate officials who often lack the knowledge and the authority necessary to ensure that the efficiency of the factory is kept up to that of the day shifts.

Milling.—To manufacture sugar as cheaply as possible, the milling of the cane should take place without interruptions, so as to grind during the twenty-four hours that amount of fresh cane which represents the normal capacity of the factory working at maximum efficiency. Very important is the proper and uniform feeding of the mill, which ensures that the layer of bagasse passing through is always of the same thickness. In order that the mill can be worked at its due capacity with a maximum of extraction, it is necessary also that the cane and bagasse be uniformly distributed along all the width of the mills : very useful aids in securing this are the various shredders, and also the different types of revolving knives.

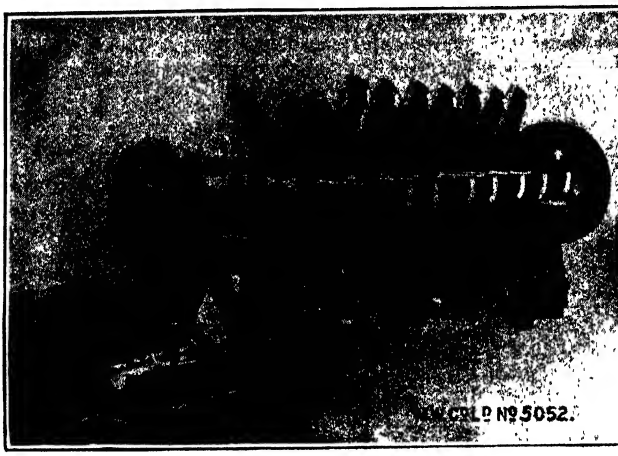
The amount of imbibition water it is decided to apply should be determined by patient study. The large modern mills with crusher and nine or twelve or more rollers are only able to give the high extractions which are to be expected of them if a goodly proportion of imbibition water is employed, and this fact should be kept well to the fore in the study of the different factors which determine the amount of water which may be profitably applied. The water employed should be as pure as possible, and contain a minimum of solids in solution. Water from artesian wells nearly always contains a considerable or even a very high proportion of dissolved solids, for which reason it is generally unsuitable to be used for imbibition.

Losses in the raw juice through fermentation.—It is necessary to avoid these losses produced in the juice before defecation by micro-organisms. Evidence of such losses is often seen by the presence under the mills and in the raw juice tanks, of a gummy substance, generally considered as dextran, and popularly called in Spanish countries, "huevos de rana" (frogs' eggs). These

[1] Translated by the author from the *Revista Industrial y Agricola de Tucuman*, Vol. XX, pp. 105-114, 1930. This paper was originally prepared for the instruction of the Argentine planters generally ; we reproduce it in our pages as we think it will be found of use to those of our readers not closely associated with the technical side of the sugar industry. It contains a number of valuable hints on the best practice in vogue in the sugar industry.—Ed., *I.S.J.*

Mirrlees'

REVOLVING CANE KNIVES



are indispensable for Efficiency with Modern Milling.

A Superintendent of five factories recently equipped with our Knives writes :—

"THE KNIVES ARE DOING EVEN BETTER THAN WHEN I LAST WROTE. **EXTRACTION IS MOUNTING UP**. UP-TO-DATE WE ARE EXACTLY 1% HIGHER EXTRACTION, ADDED WATER 20% AGAINST 26%, AND CAPACITY 15% GREATER, THIS IS VERY SATISFACTORY."

Revolving Cane Knives pamphlet S. 124 *may be obtained from any of our Agents.* (*Spanish issue S.* 124A.)

MIRRLEES WATSON
COMPANY LIMITED

ENGINEERS, SCOTLAND STREET, GLASGOW.
London Office - Mirrlees House, 7, Grosvenor Gdns., S.W.1.

050

losses by fermentation may be avoided by keeping scrupulously clean the mills, raw juice tanks, pipe-lines, etc.; every time the mill stops, even for a few minutes, these should be thoroughly disinfected, with a steam hose in the first place, and then with lime cream, formol, ammonium fluoride or other convenient disinfectant. It is usual to pay little attention to these possible losses, considering them as too small to be of any consequence. Nevertheless, we have known a case where they amounted to one per cent. of the sugar entered !

Defecation.—The basic principles of defecation are so well known that many will be surprised to learn that considerable losses are frequently produced in this section of the factory. For we are between two fires, so to speak : on the one hand we have the danger of excessive acidity, and on the other that of alkalinity in the juices. If the defecation leaves the juice too acid, it will settle badly in the decantation tanks, making it necessary to send an excessive quantity of " bottoms " to the filter presses, where filtration will be slow and difficult. And if in this case an excessive amount of lime be added in the scum tanks the filtered juice may be too alkaline, with all the serious consequences which this entails. For if the defecated or filtered juice is alkaline the free alkali will destroy the invert sugars with the production of viscous and acid substances, so that this alkaline juice will be acid when it comes from the evaporators and contain gummy substances which slow down the boiling operations and increase the amount of molasses obtained.

Much vigilance is necessary therefore, in this section of the factory, if the juices are to be properly defecated. Seeing that the cane ground is constantly varying—as to variety, district where grown, age, etc.—especially that of the innumerable bundles of cane growers' cane, the natural acidity of the raw juice is constantly varying also, and therefore also that of the sulphured juice. Thus the amount of lime cream which must be added to produce the desired reaction must be varied constantly unless a considerable proportion of juice is going to be improperly clarified. We have frequently found on the other hand that the proportion of lime cream is not varied from one day to another, and sometimes during several days ! In general, the defecation and decantation carried out during the night shift is not so good as that done during the day, a fact which implies considerable losses.

Decantation.—It is surprising the number of *ingenios* in which the decanted juice is imperfectly separated from the muddy juice, either because the decantation tanks and their outlet pipes and cocks are badly designed or constructed, or because of indifferent handling. The late Dr. W. C. Stubbs showed that well decanted juice is even freer from particles in suspension than filtered juice, and as a matter of fact there is no reason for tolerating even the slightest lack of clarity and absolute freedom from suspended particles in the decanted juice, even that taken from the storage tank.

In some factories the decantation is adversely affected by lack of cleanliness in the decantation tanks, which of course should be thoroughly washed out after each settling, as otherwise it is impossible to obtain the necessary perfect settling of the juices.

Evaporation.—Seeing that evaporation in multiple effect is more economical than in simple effect, it is desirable to concentrate the juices in the evaporators until a good thick syrup is obtained, say of from 60-65 Brix, or even a little more. Many factories are content to concentrate only to 40-50 Brix, which means to say that they leave unnecessarily an excessive proportion of water in the syrup which must be evaporated off in the vacuum pans, thus

reducing the effective capacity of these as well as removing the surplus water in an uneconomical manner.

The efficiency of the concentration of the juice in the evaporators is frequently much reduced by scale formation on the tubes, etc. This can be prevented to a large extent by properly defecating, decanting and filtering the juices. The different bodies should be cleaned with such frequency as to ensure that no accumulation of scale takes place.

Boiling.—One of the most frequent causes of loss in this section of the factory is the returning of low products, which causes the massecuites to become viscous and difficult to purge in the centrifugals, and produces a considerable increase in the proportion of molasses obtained. Especially when the sugar made is remelted and refined in the same factory, the low refinery syrups being returned to the raw sugar section and mixed there with the syrups, there is much danger of difficulties and losses being produced by the continual returning of small quantities of such low syrups. These losses can be largely prevented by reducing to a minimum the return of low products in the boiling house, and by affining thoroughly the sugar to be refined, so that before remelting they are as completely as possible freed from molasses. It should not be forgotten that even in the largest refineries the first operation is a thorough affining of the raw sugars, in order to separate by this physical means all the molasses adhering to the crystals, before these are remelted.

Sugar boiling is a real art, and the yield obtained in each strike, as well as the quality of sugar produced, depend very much on the skill and care employed by the sugar boiler. For this reason, in many parts the sugar boilers are carefully selected, highly skilled men, who are very well paid, as it is recognized that high efficiency of the work in this section increases considerably the yields obtained, and reduces the losses and the manufacturing costs.

Refining.—As we have just stated, the secret of sugar refining lies in employing as material for the re-melting sugar of the highest quality possible, so that the melt will be at least of 99 per cent. purity—this being done by thoroughly affining the raw sugars before melting them up. For it must be pointed out that if this is considered indispensable in the large foreign refineries of enormous daily capacity, which refine with high efficiency on the basis of boneblack treatment, how much more necessary must it be in factories which refine their own sugars, either without any kind of decolorizing carbons, or with these employed only on a small scale.

It is very necessary that the sugar melt should be perfectly filtered, in order to remove therefrom all suspended particles, as otherwise the refined sugar will have a " dead " appearance, which affects considerably its acceptation on the market.

If the refining is done with animal charcoal, one must be sure that this is of good quality and high decolorizing power, both when new, and after having been revivified. It is easy to determine in the laboratory the decolorizing power of the boneblack employed, in comparison with the samples of standard products obtained from abroad, and it is recommended that this test be made frequently.[1] A sugar melt of high purity, which has been treated with boneblack, should give at least three successive boilings of first class refined sugar before the syrups are returned to the "factory" section.

A very important point in the refining of cane sugars in the factory is the degree of acidity of the liquors, massecuites, etc. It is very possible to commit grave errors in this matter, especially by factory people who are used to carrying an appreciable degree of acidity in their syrups, etc., without noting any

[1] In the Argentine the factories make their own boneblack from bones obtained locally.

inversion, for it is a fact that an acidity which will not do any harm in the relatively impure factory syrups will produce considerable losses in the highly purified refinery liquor. This is due to the presence of non-sugars in the factory products, principally salts, which reduce the effective acidity—the concentration of the hydrogen ions—of the acids present, which substances are not present in the high purity liquors, in which medium therefore the effective acidity of the acids present is much greater. If the control is kept by the hydrogen ion determination, the danger of loss by inversion is more easily avoided.

Of great importance to *ingenios* making white sugar, and especially those which refine their products by remelting, is the daily control of possible losses by inversion, by carrying out frequent determinations of the glucose coefficient of the different products, i.e., the ratio between the "glucose" and sucrose contained in the juices, syrups, massecuites, liquors, etc. But for this control to be of value it must be carried out on the basis of gravimetric determinations of glucose, and true sucrose (Clerget) estimations, as the common methods of glucose determination, and "polarization" results do not give data of sufficient exactitude to control the inversion effectively.

The kind of sugar it is most profitable to manufacture.—Even to the *ingenios* who are fully equipped to refine sugar with boneblack, the question often presents itself as to whether it is more profitable to make refined sugar, or to be content with making granulated without remelting, owing to the variations in the margin between refined and plantation granulated sugars. For while refined (Pilé) sugar is always worth more than granulated, it costs much more to make, as besides the additional costs which are implied by the affining, remelting, filtration, decoloration, boiling and purging, etc., of the process of refining, we have to take into account the mechanical and chemical losses of the process, which appreciably reduce the yields,—and also the prejudicial effect on the whole manufacturing process of the return of the low refinery syrups to the raw sugar section of the factory. Taking into account all these and other factors, we are inclined to believe that the difference in cost between manufacturing Pilé and granulated is considerably higher than is generally supposed. It is true that the refined product is easier to keep for long periods without deteriorating than is plantation granulated, but on the other hand the keeping of this without deterioration is only a matter of employing suitable, specially constructed warehouses.

In the well managed factory the decision as to the best kind of sugar to make will only be reached after carefully calculating the real costs of manufacture of the refined and non-refined product.

Losses.—The losses of sugar in the factory may be classified as follows :—(1) in bagasse; (2) in filter-press cake; (3) in molasses; and (4) undetermined. They should all be reduced to as low a limit as practicable, without of course spending more in recovering sugar than this is worth. The sugar lost in bagasse can be reduced with modern mills to a very low limit, employing ample imbibition water, but of course there is an economic limit to the amount of water which can profitably be employed, which limit should be carefully determined for each factory several times during the crop. The sugar lost in filter-press cake can also be greatly reduced, by washing the cake thoroughly in the filters, or by double decantation or double filtration, but one must be careful not to pass the limit where the sugar recovered costs more than it is worth.

The quantity of molasses produced, as also the proportion of sugar which it contains may be considerably reduced in some factories, by employing more care in defecation and filtration, and especially by reducing to the lowest limit possible the return of low products in the boiling. A very common fault of sugar factories is not to have a sufficient crystallizer capacity, so that the final massecuites can only be cooled off for a few hours instead of the three or four days which would be necessary to produce a maximum yield of sugar crystals. In such *ingenios* the installation of additional crystallizers as may be necessary would permit of the obtaining of a much greater exhaustion of the molasses, while the expenditure needed would not be great.

Undetermined losses.—By " undetermined " losses we mean the sugar lost in the factory apart from that contained in the bagasse, filter-press cake, and molasses, i.e., the sugar which disappears during the process of manufacture through mechanical or chemical causes. We have known these losses to reach the figure of 0·3 per cent. of the weight of the cane, or even 3 per cent. of the total sugar contained in the cane, this representing a very large amount of sugar per day in any factory of reasonable size.

The mechanical losses may be caused by leaks in the tanks and pipe-lines of juice, syrups, etc., and in other such ways, which with a little care can easily be prevented. Serious losses are also sometimes produced by entrainment from the evaporators and pans, which of course can easily be prevented with suitable installations of *ralentisseurs*, and by working with proper care.

Chemical losses may be produced by burning sugar during the evaporation and boiling, the result of bad work which nevertheless occurs more frequently than is generally supposed. Another cause of chemical losses is the inversion of the sucrose, which as we have said can be avoided in large part by taking care of the reaction of the products in treatment. Finally, it must be remembered that a certain amount of sugar is destroyed by heat in every boiling, for which reason the number of boilings to which the sugar in process is submitted should be limited to the minimum possible.

Chemical aids, clarifying substances, etc.—Certain chemical substances are employed in sugar manufacture, such as lime, sulphur, phosphoric acid, kieselguhr, " clarafina," neutral sodium phosphate, blankit, blue, formol, muriatic acid, caustic soda, animal charcoal, vegetable carbons, etc. If sugar is to be produced at the lowest possible cost, the quantity and quality of the chemical substances used must be very strictly controlled.

With regard to the quantities used, we would say that in many cases these are excessive, and that, indeed, it frequently occurs that such substances are employed without any necessity at all. Phosphoric acid, kieselguhr, " clarafina," and sodium phosphate, for example, are useful aids in defecation and filtration, but they are costly substances which should be employed, if at all, only in the smallest quantities possible. The same can be said of blankit and blue, used to improve the colour of the sugars : if they are used it should only be when really necessary, and in proportions which are decided upon with due regard to their high cost. In many cases the necessity of employing the aids to clarification is due to defective methods of defecation and filtration, etc., and the use of hydrosulphites and blues in the refinery is made necessary by deficiencies in the work with boneblack or vegetable carbons. The remedy under these circumstances is to correct the deficiencies in the routine processes, and thus avoid the use of these expensive substances.

It is also necessary to exercise a strict control of the quality of the substances employed, making purchases on the basis of the analysis of samples

submitted, and being sure that the goods delivered are strictly according to sample. For substances of inferior quality are not only unsatisfactory in use, but also in many cases productive of absolutely pernicious results in the factory. If an inferior quality of lime is employed, for example, the juices settle badly and are difficult to decant, the scums are difficult to filter, much scale is produced in the evaporators and pans, and the amount of molasses produced is apt to be increased. Kieselguhr and "clarafina" are often of poor quality, making it necessary to use larger quantities than normal to produce the desired effect in the defecation or filtration, and even in some cases producing much scale in the evaporators and vacuum pans. We have encountered inferior blues which it has been necessary to employ in double the usual quantity to obtain the same effect as with the standard article. Boneblacks and vegetable carbons also vary greatly in their decolorizing power.

We would also point out that it is very necessary to control carefully the prices of these chemicals, as frequently they are sold in extra-European countries at prices which are quite excessively high.

Fuel and steam economy.—The enormous differences which exist in the fuel consumption of the different factories in Argentina, in terms of extra fuel per ton of cane, should have the effect of causing those whose fuel consumption is high, to investigate thoroughly the causes of this unnecessary expense. The proportion of extra fuel which is needed will depend on the quality of the bagasse, the efficiency with which it is burned in the furnaces, as also the efficiency with which the additional fuel is burned, and the efficiency of the steam production and use. To ensure economy in the use of steam in the factory all escapes from pipe-lines, joints, etc., must be rigorously prevented (these, by the way, in many factories are often much in evidence). In the second place, all heating and evaporating apparatus must be as clean and free from scale as possible. And, finally, the steam should be used in accordance with a definite scientific plan of steam utilization, designed to obtain the fullest benefit from both live and exhaust steam, and to ensure a steam balance as perfect as possible. This is an aspect of the factory which would very well repay the most careful study in many *ingenios*.

By-products.—In producing sugar at the lowest possible cost, the fullest advantage must be taken of the by-products. The filter-press cake and the ash from the furnaces are fertilizers of some value, and should be returned to the fields; and the molasses should be made use of, in the first place for the manufacture of alcohol, and for the feeding of animals. The manufacture of alcohol should be carried out in a scientific manner, so that a maximum of profit will be obtained from this department; the molasses should be fermented with pure yeasts of high alcohol production, and the fermented mashes distilled and rectified with the greatest care, so as to obtain alcohol of the highest quality possible. It is necessary to correct also one of the chief faults of plantation distilleries, i.e., that of using uneconomically steam and fuel; for these should be employed in the same scientific way in the distillery as in the sugar factory.

Rustless Iron.—Iron can now be aluminized at 900°C., according to the method of Harry Johansson, a Stockholm metallurgist. The aluminium partly permeates the iron as well as covering the surface, so that the resistive and protective power is great. The Sandviken Iron and Steel Works has acquired the sole rights to the process for Sweden, Norway, Denmark, and Finland for cold-drawn and rolled tubes and cold-drawn band iron. The invention is patented and is being exploited by the Aktiebolaget Stockholms Aluminiseringsfabrik.

Abstracts of the International Society of Cane Sugar Technologists.

Under the scheme instituted by the International Society of Cane Sugar Technologists a collection of abstracts of papers on agricultural and technical subjects is prepared monthly. A selection has been made by us from the material issued, and appears below :—

BEET SUGAR MANUFACTURE.

CHARACTER OF SOIL AND SUGAR CONTENT OF BEETS. **Editorial.** *L'Ind. Sacc. Italiana*, 1930, **23**, 499-500.

To see whether soil or climate was of more influence in determining the character of beets, 20 tons of Italian soil was transported from the Rovigo experiment station to the Zapotil seed plantation near Prague, and a like quantity of soil from the Bohemian plantation was transported to Rovigo ; in each case the imported soils were comparatively tested with sugar beets against the local soils. Both at Rovigo and at Prague the Bohemian soil yielded beets with higher sugar contents than the Italian soil, thus showing that the climatic factor is of subordinate importance in determining percentage sugar content, and that the character of the soil has the greater influence, at least in this instance.

ACTION OF SULPHIDES ON FILTER-CLOTHS. **O. Spengler.** *Deutsche Zuckerind.*, 1931, **56**, 17-18.

Alkaline sulphides have a very destructive action on filter-cloths. Under certain circumstances sulphur is sublimed from the raw materials of the lime kiln which supplies the carbonic acid gas. The author has, in fact, been able to demonstrate the presence of elemental sulphur in the press muds from the first carbonatation. In this highly alkaline medium the sulphur reacts with lime, and especially with traces of the alkalis, always present in the limed juice to form sulphides and polysulphides. The polysulphides are especially liable to oxidation in the presence of air, with formation of neutral sulphates and free sulphuric acid, which is the active agent in causing destruction of the fibres of the filter-cloths. The reason why the sulphuric acid escapes neutralization by the great excess of lime is that polysulphides have a marked affinity for cellulose ; the polysulphide is thus absorbed by the cloth. When subsequently exposed to the action of oxygen, the acid is liberated in the fibre. A sugar factory that had excessive filter-cloth consumption had appreciable amounts of H_2S in its carbonatation gas, whereas in factories where cloth consumption was normal or low only traces were to be found.[1]

INFLUENCE OF PRE-LIMING ON JUICE WORKING AND SUGAR QUALITY. **E. Naehring.** *Deut. Zuckerind.*, 1930, **55**, 1353.

Raw juice in the measuring tanks is pre-limed with 0·15 to 0·20 per cent. CaO, and after being rapidly heated to 90-95°C. enters a storage tank in front of the first tank of the first carbonatation station, through an overflow pipe. Milk-of-lime to the amount of 1·25 per cent CaO is admitted into this overflow pipe. Contact of the juice with the free lime is only momentary, as the limed juice encounters the carbonic acid gas on entering the tank. After passing the first carbonatation station the juice has an alkalinity of 0·03 per cent. CaO. The second carbonatation consists of two tanks : the first of these receives an addition of 0·05 per cent. CaO, and the juice in this tank is carbonatated. Sulphur dioxide gas from a bomb is admitted into the overflow pipe between the first and second tanks, and to the juice in the second tank the

[1] That sulphides rot filter-cloth was recently pointed out by another writer. See *I.S.J.*, 1931, 37.

necessary amount of soda for deliming purposes is added ; the final alkalinity is 0·017-0·012. After carbonatation the juice follows the usual course. The results of this process, in comparison with the process of adding all the lime in the first carbonatation tanks, are characterized as remarkable. The press muds from the first carbonatation often showed no sugar (average 0·025 per cent.). a fact verified by analyses at the Berlin Sugar Institute. The quality of the first product sugar rose from type 4·1-4·3 to type 5·0, and the yield from 90·71 to 91·77.

INFLUENCE OF PRODUCTS OF DEXTRAN FERMENTATION ON LIMING AND CARBONATATION OF JUICE. **W. Konn.** *Zeitsch. Zuckerind. Czechoslov.*, 1930-31, **55**, 131-139.

One of the products of fermentation by *Streptococcus mesenteroides* or *Leuconostoc mesenteroides* is dextran, an anhydride that forms slimy clumps resembling frogs' spawn, not infrequently observed in factories where strict sanitation is not maintained. Its presence often causes serious difficulties in filtration. The author finds that dextran goes into solution under the action of lime at 85°C., the amount dissolved depending on the time, but that it may be thrown out by carbonatating at the same temperature. When dextran fermentation has occurred in the raw juice, the dextran may therefore be disposed of by liming the juice at a temperature not below 85°C., and keeping it at this temperature for five or ten minutes. Subsequent carbonatation then insures its complete removal.

MOVEMENT OF NITROGENOUS SUBSTANCES IN THE BEET SUGAR FACTORY. **B. A. Liasko.** *Naukovi Zapiski*, 1930, **10**, 23-38.

The author has studied the movement of nitrogenous substances of the sugar beet through the various stages of the factory process during an entire campaign at the Ouzin factory. The results are given in ten tables and two diagrams, of which one diagram is here reproduced. From the data it is seen that the amount of harmful nitrogen increases with the length of storage of the beets and as their quality becomes poorer. A little more than half of the total nitrogen in the beet is albuminoid, most of which is thrown out in the diffusion process and the first carbonatation, but which under certain working conditions may be partly re-dissolved. Over 96 per cent. of the nitrogen in the syrup, and 90 per cent. of that in the final molasses, is classed as "harmful nitrogen."

AUTOMATIC FACTORY CONTROL, DABROWSKI SYSTEM. **A. Blazewski.** *La Betterave*, 1930, No. 539.

In the Polish sugar factory at Wlostow, capacity 1300 tons of beets per day, the DABROWSKI system for automatically registering the continuity of operations in a sugar factory has been applied to the beet scales, juice measuring tanks, the diffusion battery and all juice pumps, including syrup pumps. When these various stations are in operation the fact is indicated by lamps in the offices of the superintendent and the manager. Besides the action of the lamps, the apparatus makes a permanent record of the time during which a pump, for example, is in operation, and the duration of shut-downs. The operating superintendent can see at once where there is a jam, or where a given station is not working to capacity. The same system is now to be extended to the centrifugal station, the boiler feed pumps, and the loading platform of the lime kiln. The system has been found to reduce greatly the amount of lost time and motion.

DETERMINATION OF NATURAL ALKALINITY AND LIME SALTS. **I. B. Minz and I. I. Shoiket.** *Naukovi Zapistki*, 1930, **10**, 131-137. (In Russian).

Compared with the DUWELL and SOLON method,[1] it appears that the BLACHER method has advantages of simplicity, accuracy, and ease of operation. In this method a solution is prepared from 9·2 grms. of pure palmitic acid and 0·1 grms. phenolphthalein in 500 c.c. of 95 per cent. ethyl alcohol and 300 c.c. of H_2O. The acid is carefully neutralized with pure KOH and made up to one litre with 95 per cent. alcohol; 1 c.c. of this solution will contain 0·007 grms. CaO. In making a determination, a sample of the juice is neutralized by titration with $N/28$ HCl. The same solution is then titrated with the palmitate solution until the pink colour of phenolphthalein is discernible; from these titrations the alkalinity and the lime content of the juice may be calculated.

CONTINUOUS MEASUREMENT OF ALKALINITY BY REGISTERING CONDUCTIVITY. **O. Spengler and F. Tödt.** *Zeitsch. Ver. deut. Zuckerind.*, 1931, **81**, 1-12.

The authors carried out measurements during a period of one week at a German beet sugar factory, using the alkalinity tester of R. LINDNER of Halle, Germany. This instrument consists of an open vessel holding about ½-litre, through which the juice to be measured is kept flowing. Two platinum electrodes dip into the vessel and are connected with a registering instrument; alternating current is used. Variations in the alkalinity of the juice cause variation in the strength of the current passing between the electrodes and the automatic registration of these variations in the strength of the current shows the variations in the alkalinity. The results of the investigation indicate the usability of the apparatus at the first liming station, but before reaching a final conclusion it will be necessary to obtain further information concerning the influence of the composition of the juice other than its alkalinity.

CANE SUGAR MANFACTURE.

CLARIFICATION OF JUICE OF FROZEN CANE. **C. F. Walton and C. A. Fort.** *Sugar Bulletin*, Nov. 19th, 1930.

The practical question, at what degree of deterioration does it become inadvisable to put cane through the factory, and what analytical methods can be used to disclose this condition, remains at present largely unanswered. Apart from the purity figure, the content of mannite (*d*-mannitol) may be a useful indication if a suitable method for its determination were worked out. A juice from frozen cane concentrated to 70° Brix was found to contain about 7 per cent. on solids of this sugar, and about 4 per cent. of a dextrorotary gum. High or low amounts of lime do not appear to offer any special advantages in clarifying juice of frozen cane.

STORAGE AND POLARIZATION OF RAW SUGARS. **L. Baissac.** *Revue Agricole, Maurice*, 1930, **53**, 183-187.

A review of knowledge concerning the safety factor of raw sugar. The author points out that factories shipping plantation white sugar to British markets have had the disagreeable experience of finding their consignments appraised as refined sugar by reason of exceeding a polarization of 99°. Since the range of error in the polarization test is several tenths of a per cent., the factories are advised not to make sugar exceeding 98·5° pol. for this market.

[1] See also *I.S.J.*, 1930, 366; 1931, 79.

Java Technical Notes.

JAVA SUGAR MILLS. **Manuel A. del Valle.** *Gilmore's Porto Rico Manual.* 1930, 67.

Java mill-houses are usually 2-floor concrete buildings roofed with zinc sheets or tiles, their flat design, chosen for greater safety from earthquake, contrasting with the higher structures in Cuba and Porto Rico. Residential quarters have well-paved wide streets with beautiful gardens and very nice-looking houses. Mills in general are very clean. The usual type of cane unloader is a sort of steam-operated rake, dragging cane into the conveyor from an inclined plane upon which the cane is dropped by a hoist which lifts the bundles from the cars. Since the cane is not cut into pieces in the fields, but is pulled out in full length, it is arranged longitudinally in the conveyor with the aid of hand-labour, thus permitting a compact feed. Cane car dumpers are under study. Java appears to believe in GUDNER'S idea of "less inventing and more constructing," so far as their mills are concerned, as years have elapsed without allowing recent successful practices of other countries to establish themselves there. Their usual mill is a one crusher and 4-mill unit, it being the belief that a 5th is not commercially practical. Mills are preferably driven by individual engines with oil-pressure regulators, or at most two mills to an engine. Cane knives are not in vogue, and reasonably so, as there is no feeding problem, as far as the crusher is concerned. Shredders have not established themselves, and Krajewski crushers predominate over Fultons. Only 3 per cent. of the mills have Messchaert grooves. Hydraulic accumulators are scarce, rigid mills with special feed rolls, not only for the mills themselves, but also for the crushers, being in favour. Rolls are usually flat and fine grooved, there being few rolls having large deep grooves as in Cuba.

Three factories have established the Nobel system of hot maceration with success. Some of the multiple effects are arranged so that one vessel can be cleaned whilst the others are in operation, while a short type of Kestner operated as a Pauly was one of the special features noticed. Vapour-compressors are also used, and experiments are being carried out with a high pressure evaporator. Wet condensing plants are being gradually substituted by dry barometric condensers, the present tendency being towards individual systems for each pan operated by multiple water jets. Of the boilers, 90 per cent. are fire-tube, operating between 6 and 10 atmos.; and of the water-tube type, the Babcock and Wilcox system predominates. Bagasse stokers are unnecessary on account of the cheap labour, besides which it is believed they do not allow an even distribution of bagasse. Most chimneys are brick or re-inforced concrete, the latter preferred because built in a shorter time and requiring less foundation, their height being 40-50 metres, producing a draft at the foot of about $\frac{5}{8}$ in. Boiler water is fed by hand, although COPE'S automatic feeder has been successful in several factories. Air pre-heating finds many advocates, both the stationary and rotary types being in use for heaters. In all factories the operation of the boilers is well controlled by the use of CO_2, steam, and temperature recording instruments to ensure boiler and grate efficiencies and diminish losses in the flue gases. Labour is very cheap, the average man's wages for a 12-hour shift being 20 cents or 10d. (half a guilder), women at the centrifugals receiving 16 cents., while some men in clarifying departments receive 40 cents, and mechanics \$1·20 per day. The directing staff and other important employees are all European, mostly Dutchmen, whose good training, disposition, and ability contribute in a large measure to the success of the sugar industry in Java.

EVAPORATOR SYRUP CLARIFICATION AT BANGSAL. **P. Honig and W. W. Alewijn.** *Archief*, deel III, No. 17, through *Sugar News*, 1930, **11**, No. 11, 660-661.

At Bangsal s.f., Java, experiments were conducted on evaporator syrups, so as to improve by suitable treatment the quality of the sulphitation white sugar there made. Much attention was paid to the opalescence of the syrup which always appears before graining, though as the result of the clarificatio or filtration of the syrup it may not have been present previously. This appearance is ascribed to the meta-stable condition of the colloidal impurities present; but it does not seem practicable to cause their flocculation early in the process of concentrating the syrup, and thus eliminate the precipitate before the grain is formed, in order thus later to obtain a sugar free from these dull-toned impurities. Their quantity is relatively considerable. *A*-syrup, *B*-syrup, and molasses were defecated each with the greatest care, and the amount of suspended non-sugars was determined, being found to be 5·58, 8·25, and 18·58 grms. respectively per kilo. of the product. Nor does this represent the total precipitation, as it appears that during further boiling these non-sugars continually flocculate. True, if the syrup be very thoroughly defecated or filtered there will be much less dirt in the syrups and molasses, giving better massecuites and sugars, but there will always be a certain quantity of non-sugars changing over from the meta-stable to the flocculated form, which precipitate of course passes into the sugar finally. In the carbonatation process, between evaporator syrup and *B*-syrup only very little precipitate will be formed, and using this method of clarification it is only on concentration to *C*-massecuites that the flocculating-out of the impurities in any considerable amount appears.

But the less thorough sulphitation process does not purify the juice so effectively. Tests at Bangsal were so planned that of a quantity of evaporator syrup half was boiled to massecuite without other treatment; while the other half was purified in different ways, as by filtration over "Hyflo," or clarification with "Norit" or yellow clay, so as to obtain an absolutely brilliant product for boiling. An experimental vacuum pan having a capacity of ½ hl. (11 gallons) was used. But even by using such treatment the development of opalescence was not prevented, or at least not entirely, though the sugars obtained (after double curing) were certainly better in appearance than those made from the untreated syrup. Following this, an experiment of interest was made. It was found that treatment of the evaporator syrup simply with phosphate and lime gave the desired result, since after such a method of clarification the syrup remained bright, even during thickening to grain. Owing to lack of time, it was not possible to develop this line of attack further, but it was promising enough to intend to follow it up later. It was, further, noticed that liquor made by re-melting low-grade sugar, when treated with a little phosphate and lime, and filtered over "Hyflo," appears to remain entirely clear during thickening to massecuite, and the sugar later obtained from it was almost as clean as a refined sugar. On the other hand, the sugar boiled from the unpurified low-grade sugar liquor was inferior.

ALKALIZING BOILER FEED-WATER WITH SODA ASH. **J. F. Bogtstra.** *Archief*, 1930, **38**, II, No. 44, 1001-1003.

Recently one has heard it stated that the addition of soda to the boiler feed-water is injurious. Thus CLAUSSEN warns against the use of carbonate of soda on the ground that this decomposes into sodium hydroxide and carbon dioxide, which constituents according to him attack the boiler-plate.

He would in its stead use the anti-incrustation preparation "Tartrizid"; while the firm of Ruhaak & Co. also declares that soda should not be used, rather that their "Algor" should take its place.[1] This question is now examined by the author. When soda ash is added to boilers, sodium hydroxide is formed, due according to PARR[2] to hydrolysis at higher temperatures, thus : $Na_2CO_3 + H_2O = 2\,NaOH + CO_2$. A Java sugar factory adds no more than 22 lbs. of soda per 800 tons of feed-water in order to maintain the desired alkalinity. Assuming that soda ash is used, and that all the CO_2 from the carbonate passes into the steam, then one has to reckon with : $44/106 \times 10 = 4{\cdot}15$ kg. or 9·2 lbs. of CO_2 per 800 tons of feed-water, or say 5 mgrms. per kg. of steam. Further, according to numerous analysis reported by the Proefstation, there is also present in the united condensates of the 1st and 2nd bodies of the evaporators at most 25 mgrms. of CO_2. Hence, in the steam one obtains at most 30 mgrms. per kg.; whereas, according to the standards of the German Boiler Proprietors' Association, 35 mrgms. is permissible. It is thus seen that, although such an addition of soda ash does not fall within the limit deemed to be harmful, yet for precaution's sake it is better to use caustic soda.

Now one comes to the second part of the question, namely, whether caustic soda is harmful to boiler-plate at high temperatures. Detailed investigations on this matter are reported by HEYN and BAUER,[3] mostly, however, at room temperature, showing a graph according to which the critical (maximum) concentration is at 0·1 and the threshold (minimum) at 1 grm. per litre. Regarding the effect of these concentrations at boiler temperatures, little is known. BOSSHARD and PFENNIGER[4] state a minimum attack, at 15 grms. to 1 grm. per litre, the critical concentration not being indicated, though it must be between 0 and 0·1 grm. per litre. On these grounds, it appears right that the above-named Association should prescribe that the so-called sodium-number ($\frac{Na_2CO_3}{4{\cdot}5} + NaOH$; in mgrms. per litre) of the boiler should be kept at 400 at least. In Java it is impossible to maintain so high an alkalinity, since the condensate used contains a fairly high content in organic matter. Priming would easily take place at such a high alkalinity, and one is therefore obliged to take the lower limit. Formerly the alkalinity of the boiler feed-water was held at 8·3 to 8·8 *pH* (determined at boiler temperature) corresponding to a sodium figure of 0 to 25. Now, on the advice of the P.S. this is raised to 10 *pH*, corresponding to a sodium-figure of 100 to 150, which lies closer to the German standard. Priming is then not to be feared. Referring to the literature, MCALLEP[5] considers a *pH* of from 8·3 to 8·8 sufficient; whilst PARIS[6] and STUMPER[7] approach to the new standard, viz., 0·2 grm. per litre. Summarizing, the present author considers that addition of caustic soda to 10*pH* can only act favourably.

IRISH BEET CRISIS.—A deadlock has been reached between the Irish beet sugar factory at Carlow and the sugar beet growers with regard to the price to be paid this year for the roots. An offer of 38s. per ton has been rejected by the farmers, and there is a danger that the factory may fail to secure the minimum acreage necessary to justify working.

[1] In correspondence with the Java Proefstation. [2] *Bulletin Univ. Illinois*, No. 94, 1917.
[3] *Mitt. Kon. Materialprufungsamt*, 1908, 26, 1. [4] *Chemiker Zeitung*, 1916, 42, 4, 46, 63 and 91.
[5] *I.S.J.*, 1929, 44. [6] *Genie Civil*, 1923, 82, 392.
[7] *Korrosion und Metallschutz*, 1928, 4, 227.

Publications Received.

Brix Tables for Cane Juice Analyses. Fourth edition; recalculated, revised and enlarged by Th. J. D. Erlee. (H. van Ingen, Sourabaja, Java). 1930. Price: $17.

Some further particulars, supplementing the notice already published,[1] may now be given. This new edition of VAN MOLL's tables, an amplification of SCHMITZ' tables, is based on the well-known formula: Sugar per cent. = polarimetric reading $\times \frac{\text{Normal weight}}{\text{Sp. gr.} \times 100} \times \frac{11}{10}$. SCHMITZ showed that the rotation varies according to the concentration, and his allowances were adopted by VAN MOLL in his tables. ERLEE shows that the SCHMITZ corrections can still be used unaltered, and they have accordingly been incorporated in these new tables. But the most important alteration in the revision has been necessitated by the adoption this year in Java of the true c.c. and of the normal temperature of 27·5°C., in place of the old Mohr's c.c., and the temperature of 17·5°C. On examining the tables it is noted that the lower Brix figures now include the range 1 to 3·9°, due to the fact that with the more intensive extraction of to-day the last mill juices now come into the range indicated. As we have already remarked, there seems little doubt that these new Moll tables will be largely adopted in countries other than Java, so carefully compiled and so convenient are they.

Textbook of Quantitative Analysis. By William Thomas Hall. (Chapman & Hall Ltd., London). 1930. Price: 12s. 6d.

Prof. HALL's name is well known as the translator of TREADWELL's "Analytical Chemistry." That book was originally intended as a brief textbook, but on publication many new analytical procedures tested by his students were included. Actually the English edition became about twice as large as the original text, being a reference book rather than student's manual. This present book is as at first planned, that is, a purely elementary course in analytical chemistry for the use of embryo chemical engineers. It is on straightforward lines, treating of elementary volumetric and gravimetric methods, described and illustrated with ample detail. It is recommended that the titration methods be taken up first, practical experience having shown that more is accomplished than when the student first attempts gravimetric work. Analytical schemes are well planned, and the scope of the work for a first year's course is a wide one. It is certain that the student working conscientiously through these methods in the laboratory will be well equipped for more difficult work. It is a textbook which might very well be adopted by those responsible for the training of the young sugar factory chemist in the general analytical work which should form part of his training before specialization commences.

Dangerous Cargo. Dr. Jules Aeby. First Supplement. (Published by the Author, at 29, Avenue della Faille, Antwerp, Belgium). 1930. Price: 12s.

This Supplement brings Dr. AEBY's valuable book of reference for shippers quite up-to-date. It now gives particulars of 132 materials in English, French and German, 49 of these entries being revisions of previous descriptions. It, and the main edition recently described,[2] should be in the hands of all those engaged in the shipment of miscellaneous products, and especially products of a chemical nature.

Bulletins on Pure Chemistry. (*A*) **Note on the Individualities of Anhydrofructose and Difructose Anhydride.** By R. F. Jackson and S. M. Goergen. Research Paper No. 224. (*B*) **The Constant Occurrence of Non-Reducing Disaccharides in Hydrolised Inulin.** By R. F. Jackson and Emma McDonald. Research Paper, No. 251. (*C*) **The Ring Structure of Mannose: The Optical Rotation of 4-Glucosido-α-Mannose.** By Horace S. Isbell. Research Paper, No. 253. (U.S. Department of Commerce; Bureau of Standards Washington, U.S.A.). 1930.

[1] *I S J.*, 1931, 82. [2] *I.S.J.*, 1931, 38.

Brevities.

AMERICAN SUGAR REFINING COMPANY.—For the year 1930, the American Sugar Refining Company refined 1,285,487 long tons of raw sugar, at a profit of $7,288,675, or of about one-fifth cent per lb. after providing for taxes and depreciation. This compares with 1,257,842 tons and $8,166,361 in 1929. The year was one of declining prices, of somewhat wider fluctuations, and of more frequent price changes and, therefore, not so favourable for earnings as the years 1928 and 1929. The uncertainties attending the enactment of the U.S. tariff and of Governmental interferences in Cuba made it a difficult year.

INDIA'S 1930-31 CROP.—According to the Pusa Sugar Bureau, the area under sugar cane in India for the 1930-31 crop is finally estimated at 2,777,000 acres, as against 2,515,000 acres in 1929-30, or an increase of 10 per cent. The total yield of raw sugar (*gur*) is estimated at 3,178,000 tons, as compared with 2,761,000 tons last year, or an increase of 15 per cent. These figures relate to about 96 per cent. of the total area under sugar cane. In addition, cane is grown on a small scale in certain other tracts in India, the average area of which for the last five years has been some 108,000 acres, with an estimated production of 124,000 tons.

PROTECTION FOR SUGAR IN BRITISH INDIA.—*Empire Production* quotes Sir Jogendra Singh, Minister of Agriculture in the Punjab, as stating at a meeting of the Indian Tariff Board last November that while the Indian sugar industry would in time be able to meet world competition without protection or with protection no higher than in many other sugar producing countries, the Government was convinced that it required protection in the early stages. They would support protection only if the revenue derived went to develop the sugar industry. It was therefore proposed to form a sugar fund by a tariff on sugar and to allot the proceeds to various districts according to the planted area. The local administrations would use the funds to encourage and develop the sugar industry. Such protection would need to be in force for at least ten years, and should take effect at once for the benefit of both government and farmers.

THE LATE DR. H. W. WILEY.—Remarkable tributes on the work and character of the former Chief Chemist of the Department of Agriculture, Washington, are paid by colleagues.[1] Dr. C. A. Browne : " The cause of pure food in America was fortunate in having as its first great protagonist a man of Dr. Wiley's courage and perseverance . . . . His unwavering fortitude, his resistance to the selfish demands of commercialism, his unfailing optimism when confronted with almost insuperable difficulties, and his sacrifice of private financial opportunities in order to serve the welfare of the people, will always remain as shining examples for future generations of chemists." W. G. Campbell : " Harvey W. Wiley personified the movement of food and drug reform in the twentieth century. He, through his sustained leadership, has won the undisputed right to the title Father of our Food Law." W. D. Bigelow : " Dr. Wiley's character combined the essential qualities that make the good public servant . . . Perfunctory performance of prescribed duties was alien to his character." Mary T. Read : " Dr. Wiley—a rare spirit such as one meets but once in a lifetime. He has left a wealth of pleasant memories to a host of friends and admirers."

DEXTROSE.—Referring to the recent ruling in the U.S. discontinuing the regulation requiring that the presence of dextrose (glucose) in manufacturing food products must be declared on the label,[2] the Corn Products Refining Co., of New York, now make the following announcement : " It is not our belief that dextrose can in all cases displace sucrose. It is not the policy of the company to urge the employment of 'Cerelose' (dextrose) except in processes where it can be shown to offer a definite economic or scientific advantage. We do not regard dextrose as in any sense antagonistic to sucrose, nor do we advocate the replacement of other sugars in a manufacturing formula without previously establishing the practicability of the change on a methodical scientific basis. 'Cerelose' is a distinct product with its own special properties and virtues." All the same, the Company are enlarging their laboratory and experiment station facilities, and invite correspondence from those likely to be interested in the use of dextrose. They are reported to be planning to double the output of their product in the near future. Now manufacturing 400,000 lbs. of refined corn sugar daily, they plan to double the capacity of their Kansas City plant and build another plant costing several million dollars.

[1] *Journal of the A.O.A.C.*, 1931, 14, No. 1, iv-xxii. [2] *I.S.J.*, 1931, 85.

Review of Current Technical Literature.[1]

"CERELOSE" (PURE WHITE CORN SUGAR). *Leaflet published by the Corn Products Refining Co., New York.*

As illustrations of the skilful propaganda now being carried on by the makers of refined starch glucose (which according to SALE and SKINNER and other authorities has a sweetening power about 50 or 60 per cent. that of sucrose), the following extracts are taken from a leaflet now being circularized by them : "Cerelose is sugar in its simplest form—dextrose. It is the form in which all sugar is finally utilized by living organisms. Long before the discovery of ordinary sugar, it was known that 90 per cent. of the fuel of our bodies came from starch foods, and that every grain of starch which these foods contained had to be changed into sugar in the form of dextrose before it could be burned in the bloodstream to provide us with nourishment and power. Cerelose is this identical sugar. But being already in the required pure form, it is ready to pass into the bloodstream, immediately to begin its work of keeping our bodies healthy and our minds alert.

"The perfecting of Cerelose, first man-made simple sugar, is one of the most brilliant achievements of modern science. In spite of its youth, Cerelose has already gained an enviable position for itself in many fields, both as an adjunct to the older sweeteners and for the numerous new uses developed since its introduction. There is very little question of what such a sugar can do to improve the desirability of manufactured food products. A sugar which can of itself, and without the necessity of undergoing chemical change, wipe out the poisonous toxins of fatigue and sickness, and which with proper physical exercise can reduce the fatty accumulations of the body, tending to keep them normal under all ordinary circumstances, and which because it is the same vital sugar which Nature herself uses, can help the feeble to new life and the strong to a greater enjoyment of their strength, needs no advocate. Increased sales have resulted from the fact that greater quantities of foods sweetened with it could be eaten by the individual because of its lack of dead-sweetness, and the ease and thoroughness with which it has been burned in the body.

"Recent developments in the fruit canning industry have demonstrated the usefulness of Cerelose in their manufacturing processes. In using Cerelose, a much denser syrup can be used without oversweetness, the osmotic pressure of such a syrup being high enough to give the protection which these low concentrations lack. This flavour-holding power of Cerelose is of inestimable value to fruit preservers and makers of syrup-packed fruits. By using mixtures of Cerelose and ordinary sugar, it is possible to prepare syrups of much higher concentration than would be possible with either sugar alone.

"One of the most persistent fallacies current with respect to sugars is the statement often expressed by persons who should know better that the value of a sugar is largely reflected in its sweetening power. As a matter of fact, there is no accurate way to measure sweetness. A mid-Western (U.S.A.) University has rated the intensity of its sweetness as approximately 70 per cent. that of ordinary sugar. In many lines this diminished intensity of sweetness has been found to be one of the sugar's distinct assets, and certainly nowhere is there a product valued for its sweetness alone. Extreme sweetness carries with it a penalty. Practically all sweet foods of the old order suffer from this killing of the mild natural flavours. Sufficient has been said to show that Cerelose is a basic sugar of the highest order with countless superiorities of its own. Its value as a sweetener is beyond question."

***This refined starch glucose is of excellent appearance being a fine, dry powder, almost dead white. Its sweetness is probably about half that of sucrose.[2] Its price at present is higher than that of ordinary sugar. There seems little doubt that for some purposes, fruit canning, for example, this sugar must find some use. But for domestic purposes in the U.S.A. or elsewhere, where sugar is bought mainly for its property as a sweetener, one can hardly believe that it will meet with any great success as a competitor of sucrose.

2 *I.S.J.*, 1922, 158 and 493.

Review of Current Technical Literature.

THE SUCROSE CONTENT OF THE CANE EXPRESSED IN TERMS OF AIR PRESSURE AND SOIL MOISTURE. **M. Keonig.**[1] *Scientific Series; Bulletin No.* 16; *Department of Agriculture, Mauritius.*

In a previous paper (1) an attempt was made at expressing by means of a numerical relation the combined effect of heat and moisture on the growth of cane. In the expression arrived at, growth during a short interval of time was expressed in terms of the prevailing air temperature and soil moisture; and, by a process of sum mation, the total height attained during the period of observation was obtained in terms of these weather factors. It has been rightly pointed out that the total height attained by the cane does not characterize uniquely the industrial value of the plant and that it would be necessary to consider as well the number of stalks per stool, the average diameter and weight of each stalk and, lastly, the sugar content of the cane. In so far as the first three of these factors are concerned, preliminary observations carried on at the Mauritius Department of Agriculture appear to indicate a close relation between the height of the cane, the number of stalks per stool and the weight, that is to say, the yield in tons per acre. It would thus seem that a figure obtained for height of cane would be, generally, closely proportional to yield in tons per acre. There remains the sugar content of the cane. The "usineer" is as much aware of the effect of heat and moisture on the sucrose content of the cane, as the planter is of the effect of the same factors on the growth of the cane. In the present paper an attempt is made at expressing the relation between observed sugar content, on the one hand, and heat and moisture on the other. Air temperature has been used, as recorded at the Royal Alfred Observatory, Pamplemousses and the Central Experiment Station, Réduit, the figures of only those factories which are sufficiently close to the two above named stations, have been considered, viz., "Beau Plan" and "Mon Désert." The amount of moisture present in the soil, expressed in terms of the amount of rainfall and the interval of time between successive falls, has been used, as derived from the observed rainfall by means of the relation obtained by TEMPANY[2] at the Irrigation Experiment Station, Médine. This relation has already been used by the writer in the paper above mentioned[3] and the reservations therein expressed as to the applicability of figures obtained from the Irrigation Station to localities widely different in respect to climate and soil, have equal force in the present case.

In order to arrive at an empirical relation between the three variables, several simple hypotheses were made which seem justified by observation: (*a*) an increase of moisture contemporaneous with an increase of heat causes a decrease in the sugar content; (*b*) a decrease of moisture, contemporaneous with an increase of heat causes an increase in the sugar content; and (*c*) the sugar content, under the best conditions of heat and moisture, approaches a limiting value. Consideration of the data has led to the adoption of an expression of the form: $R = Ce^{-(ah + bt)}$; where: R is the sucrose content, expressed in percentage; C, a and b, constants to be determined, h and t, moisture and temperature figures expressed in inches of water and °C. respectively, and e, the base of natural logarithms. The introduction of the data in the algebraical expression gave a number of observation equations which, solved by the method of least squares, have yielded the numerical values of the constants. The empirical relations arrived at were thus found to be: For "Beau Plan": $R = 13{\cdot}568e^{-0{\cdot}09017h + 0{\cdot}01108t}$; and for "Mon Désert": $R = 7{\cdot}780e^{-0{\cdot}01675h + 0{\cdot}0297}$. At "Beau Plan" using the above formula and the possible optimum values of 2·50 in. for soil moisture, and 27°C. for air temperature, the maximum sugar content would approximate to 14·5 per cent. At "Mon Désert" with 2·50 in. and 23·0°C., the value similarly found would be 14·8 per cent. It would seem from the foregoing that the calculation of the probable sucrose content of cane, at least for typical localities of the Colony, could be performed with sufficient accuracy for practical purposes if more extended series of temperature observations, and especially observations of the moisture content of the soil, were available. Such calculations would be important and instructive when performed on figures

1 Statistician, Department of Agriculture, Mauritius.
2 Scientific Series, Bulletin No. 14; Department of Agriculture, Mauritius.
3 General Series, Bulletin No. 36; Department of Agriculture, Mauritius.

obtained for different varieties of cane and different cycles of growth (virgin and ratoons); and from the industrial point of view would be as important as the possible computation from weather data alone of the probable tonnage to be harvested.

FUEL VALUE OF MOLASSES; BOILER PLANT EFFICIENCIES. **E. R. Behne.**[1] *Proceedings of the First Annual Conference of the Queensland Society of Sugar Cane Technologists,* 1930.

First, the gross calorific value of the molasses from 10 Queensland mills was determining using the bomb calorimeter with the average result of 5380 B.T.U./lb. (the g.c.v. being the total heat units evolved in combustion, including those in the gaseous products formed, and those in the water derived from (*a*) the water in the molasses, and (*b*) the water produced by combustion of the hydrogen and oxygen in the dry molasses). Queensland mills use 30-50 per cent. excess air; assuming 50 per cent. with an initial temperature of 80°F. and flue gases at 500°F., then the heat loss in the flue gases is 562, plus that in the water, 861, plus the value of the residual carbon in the ash, 538, giving 1961 as the total losses; hence the available heat 5380 — 1961 = 3419 B.T.U. This will evaporate from and at 212°F., 3419/970, 3·53 lbs. of water. An average coal evaporates 10 lbs., hence 10/3·53 = 2·84 lbs. molasses = 1 lb. of average coal; and the molasses from 100 tons of cane = 3·0/2·84 = 1·1 tons of average coal.

When molasses is burnt alone, the ash is not fused, but mixed with bagasse the fusing point is considerably lowered with the result that the potash is unavailable. A sample of South Johnstone molasses ash showed no sign of fusing at temperatures about 1300°C., whereas mixed with bagasse ash it fused readily at 1110°C. Molasses may be introduced into a furnace of the bagasse type either (*a*) sprinkled on the bagasse, when it gives rise to much swelling, causing the formation of a large coke, which interferes with the air supply, or (*b*) sprayed into the furnace, which eliminates the difficulty just mentioned. In either case, however, there remains the serious drawback in that the combined ash is easily fusible. Experiments were therefore made to see if any substance could be economically added to the mixed fuels to raise the fusing point sufficiently to prevent fusing of the resulting ash. From preliminary experiments silica appeared out of the question; alumina was found to raise the fusing point; but lime appeared the best substance to use. Its effect was tried on the molasses ash from two mills, when it was found that whereas without lime the fusing temperature (as determined by the Segar cone method) was about 1100°, this with the addition of 100 parts of lime to 100 of mixed ash was raised to about 1380°C.

Until recently it has been the practice for all mills in Queensland to use large quantities of extra fuel; but in 1929 for the first time several mills in the North worked on bagasse alone. That this state of affairs indicates very poor boiler efficiency on the part of those using extra fuel is shown by the following calculation. Total steam used in mill per 100 lbs. of cane, 66 lbs.; this raised at 120 lbs. per sq. in. from feed-water at 80°F. would require 75,834 B.T.U.; 100 lbs. cane giving 25 of bagasse, the B.T.H. in bagasse equals 98,500; 100 lbs. cane give 3 lbs. molasses, and the B.T.U in the molasses therefore equals 16,140, a total of 114,640, an efficiency of 66·15 per cent. This with ordinary boiler control should easily be maintained, and with the installation of economizers, air pre-heaters, etc. should enable efficiencies up to 80 per cent. to be practicable. In the case of the factories using extra fuel the boiler plant efficiency is probably below 50 per cent.

BOILER CONTROL. **H. Horton.** *Proceedings of the First Annual Conference of the Queensland Society of Sugar Cane Technologists,* 1930.

"Control of the boiler house efficiency by means of instruments has been too long neglected. The first to be used is a draught gauge, and it should be installed in front of the furnace. The ordinary U-tube type is not very satisfactory, and the writer recommends an inclined tube gauge which can be easily read by the firemen

[1] Division of Mill Technology, Bureau of Experiment Stations, Mackay, Queensland.

who will soon learn to use it intelligently. The next is a boiler-room Orsat, which shows the best draft for a given furnace and the effect of variations in the fire on the steaming and CO_2 content. CO_2 recorders on the main flue or on the back of the boiler are of little use, as they should be placed where the fireman can see them, when they will soon learn what causes low CO_2 figures and quickly realize that good CO_2 results mean less work. During the past year steam meters were installed in several mills and interesting data have been accumulated. It has been conclusively proved that the boiling-house is not responsible for such wide variations in steam demand as it had been credited with. Charts show the total demand for steam in one Queensland mill to be astonishingly regular. Moreover, it has been proved that the rate of food in an individual boiler can vary within wide limits when every one thinks it is quite steady. The following suggestions for boiler house control in an effort towards better work are given : (*a*) Find out what the boilers are actually doing before making guesswork alterations. (*b*) Place the control of the bagasse and the fires in the hands of the fireman and not in the hands of the men in the bagasse loft. (*c*) Make the regulation of the bagasse as easy as possible—also allow easy manipulation of the dampers. (*d*) Instal instruments to give the men an opportunity to see what they are doing. (*e*) Make a trial balance from the results to get a rough boiler efficiency and steam balance. If then you are still burning extra fuel or have a shortage of steam, it will be evident which furnaces are at fault. Other suggestions which can be utilized are: (1) Alter some furnaces to step-grate type, confine the altered furnaces to bagasse only and carefully check the results. These grates can be designed, generally, together with their furnaces from the tabulated data. (2) In designing, do not be afraid of high furnaces and large throats as combustion engineers the world over are adopting them. (3) Last, but not least, remember that excess air is the biggest thief of steam; next come radiation losses and leaks. As these are the cheapest to stop, attend to them first." Lastly the author refers to the "bagasse nuisance," undoubtedly due to the high milling rates now in vogue, and to the fact that grate areas have not been expanded to cope with the large quantity of fuel. Lower draughts with larger furnaces and decreased combustion rates may mitigate it; but, as in the case of "fly ash" which gives trouble at all large power stations, one may have to seek a remedy in some grit arrestor, as the "Cinder Vane Fan," the "Pneumacone," the "Sirocco," the latter appearing to be the most widely adopted, 34 being installed in one British power plant.

RATED CAPACITY OF INDIVIDUAL ITEMS OF SUGAR FACTORY PLANT COMPARED WITH ACTUAL OPERATION.[1] **Theodore O. Nickelsen.** *Sugar News*, 1931, **12**, No. 2, 95-96.

Below are given specifications of the plant of the Maao Central, Philippines, together with the nominal capacity in tons of cane in 24 hours, the actual capacity throughout being 2700 tons; together with remarks on the efficiency observed :—

Plant	Nominal capacity	Tons actually milled
2 Mills (15-roll and 9-roll, respectively)	3000	2700
6 Boilers, 3600 H.P.	2700	,,
4 Heaters, 2800 sq. ft. H.S.	2800	,,
14 Settling tanks, 9600 cu. ft.	2250	,,
10 Filter presses, 9000 sq. ft. F.A.	2250	,,
1 Evaporator, 22,500 sq. ft. H.S.	2250	,,
4 Pans, 5460 sq. ft. H.S.	2700	,,
22 Crystallizers, 26,900 cu. ft. capacity	2600	,,
10 Centrifugals No. 1, 202 sq. ft. Screen Area	2870	,,
20 Centrifugals No. 2, 418 sq. ft. ,, ,,	2826	,,

The efficiency of the mills and boilers was above average; while that of the heaters was rated as "good," no live steam being used there at any time. But the capacity of the settling tanks was strained beyond the limit of good operation, the operation of the filter-presses being classed as "medium." Live steam had to be used

[1] Other references to capacities of cane factory plant are: *I.S.J.*, 1920, 156; 1922, 196; 1924, 88; 1926, 34, 158; and 1928, 386.

in the evaporator part of the day, otherwise owing to incrustation its capacity could not have been maintained, or else part of its work would have had to have been transferred to the pans. Work at the pans was "above average," provided the syrup supplied was not below 53° Brix. The crystallizers were not seriously taxed when the purity of the juice first expressed ranged about 80°, but the method of superimposing these instead of having them all on the same level is not to be recommended. The centrifugals were in order, being in fact found capable of working at the rate of 3000 tons of cane per day if required. There is no doubt, it is remarked, that under emergency conditions, and with juices of higher purity, the factory could exceed the above figures by a considerable margin.

BINS FOR THE STORING OF WHITE SUGAR IN BULK IN THE U.S.A. **H. L. Hartburg.** *The Sugar Press*, 1930, **14**, No. 12, 16-17. At the Wheatland, Wyoming, factory of the Great Western Sugar Co. granulated sugar is now stored in bins. Four of them have an interior diameter of 35 ft. and an interior height of 75 ft., and these are grouped tangentially in a square, this arrangement therefore giving an intermediate 5th smaller bin. Each of the four large bins has a capacity of 26,000 × 100 lb. bags, and the middle one 8000 × 100 lb. bags, making a total of 112,000 × 100 lb. bags, or 5600 short tons. Provision is made for the temperature and moisture control of the air in contact with the sugar.—DETERMINATION OF GLUCOSE (DEXTROSE) IN INVERT SUGAR, HONEY, ETC., POLARIMETRICALLY, IN THE PRESENCE OF SODIUM BISULPHITE. **Yoshinori Tomada and Tamio Taguchi.**[1] *Journal of the Society of Chemical Industry of Japan*, 1930, **35**, No. 11, 434-441B. In the presence of sodium bisulphite the polarizations of *d*-glucose, *l*-xylose, *l*-arabinose, *d*-galactose and lactose are markedly lowered, that of maltose slightly so, whereas those of *d*-mannose, sucrose, raffinose, dextrin and *d*-fructose are scarcely affected. Thus the polarization of a glucose solution which contains 30 grms. of sodium bisulphite and from 1 to 24 grms. of glucose in 100 c.c. falls as low as + 0·5° to —0·5°V., using the 200 mm. tube. From the fact that in the presence of a sufficient quantity of sodium bisulphite (30 grms./100 c.c. in most cases) the polarization of glucose becomes almost negligible, whilst that of fructose is scarcely affected, it is possible to determine glucose and fructose in their mixtures. This "bisulphite-polarization" method may be advantageously applied in the analysis of invert sugar, honey, hydrolysed products of starch and similar products.—MOLASSES ASH ANALYSES. **E. R. Behne.** *Proceedings of the First Annual Conference of the Queensland Society of Sugar Cane Technologists*, 1930. Determinations were made of the ash in 13 Queensland molasses, the average figure of 8·08 per cent. being obtained. Analyses of the ash from the molasses of four mills gave the following extremes: SiO_2, 1·86-6·60; Fe_2O_3, 0·50 (in all four); Al_2O_3, 0·18-0·68; MnO, 0·05-0·09; CaO, 10·27-16·58; MgO, 5·45-11·37; K_2O, 37·48-41·78; Na_2O, 0·60-3·03; Cl_2, 12·50-16·64; CO_2, 2·62-13·22; SO_3, 3·66-9·59; P_2O_5, 1·53-8·50 per cent. Dr. GEERLIGS' figures, given in his book,[2] show lower figures for CaO and MgO; K_2O is a little higher; and of course the Cl_2 is lower and the CO_2 higher than the Queensland figures now given.—REPORT OF THE NEW YORK SUGAR TRADE LABORATORY. **F. W. Zerban.** "The total number of samples polarized during 1930 amounted to 18,080. These samples represented an average of 2184 packages each, compared to 1620 in 1929, and 1666 in 1928. The previous maximum was 1721 and the large increase in 1930 largely accounts for the falling off in the total number of samples. The average polarization of all samples was 96·63, and increase of 0·06 over the previous year. The difference between the highest monthly average (96·80) and the lowest (96·47) was 0·33, considerably larger than in 1929. The percentage of samples testing between 96 and 97 has fallen from 63·18 in 1929 to 59·66 in 1930, while that of samples between 97 and 98 has increased from 22·23 to 25·39. The relative number of samples polarizing between 95 and 96 has been further reduced from 11·73 per cent. to 9·91 per cent., but that of samples below 95 polarization has risen a little, from 1·84 per cent. to 2·28 per cent."

J. P. O.

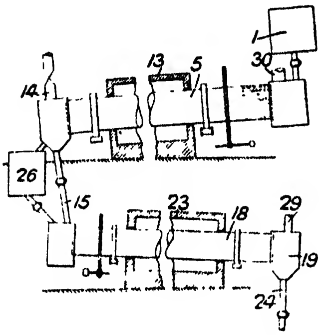
1 Department of Applied Chemistry, Faculty of Engineering, Tokyo Imperial University.
2 "Cane Sugar and its Manufacture." (Norman Rodger, London).

Review of Recent Patents.[1]

UNITED KINGDOM.

MANUFACTURE OF BONE-BLACK (ANIMAL CHARCOAL). **Baugh & Sons Co.** (assignees of **Thorne L. Wheeler and John B. Carpenter, Jr.**, of Cambridge, Massachusetts). 338,476. April 4th, 1930.

Bones are distilled to make bone-black in two stages, the first being from one to two hours at 900-1300°F., and the second for 5-15 mins. at 1500-2000°F., the bones being agitated, for example in rotary retorts, and the treatment being continuous. Suitable apparatus comprises two rotary retorts 5, 18, externally heated in furnaces 13, 23, the bones being fed in from a hopper 1, and transferred from the upper retort to the lower through a conduit 15, final discharge of bone-black being from a hopper 19 and valved conduit 24. Distillates are withdrawn through outlets 14, 29 and 30. A receptacle 26 is provided which may be used to store material other than that treated in retort 5, and its content used to replace or augment the material retort 5. This process, it is stated, produces better and more uniform quality of product, which is more active as a decolorizing agent. That it reduces the time of charring, the amount of labour, and the consumption of fuel are further claims as to its advantages.



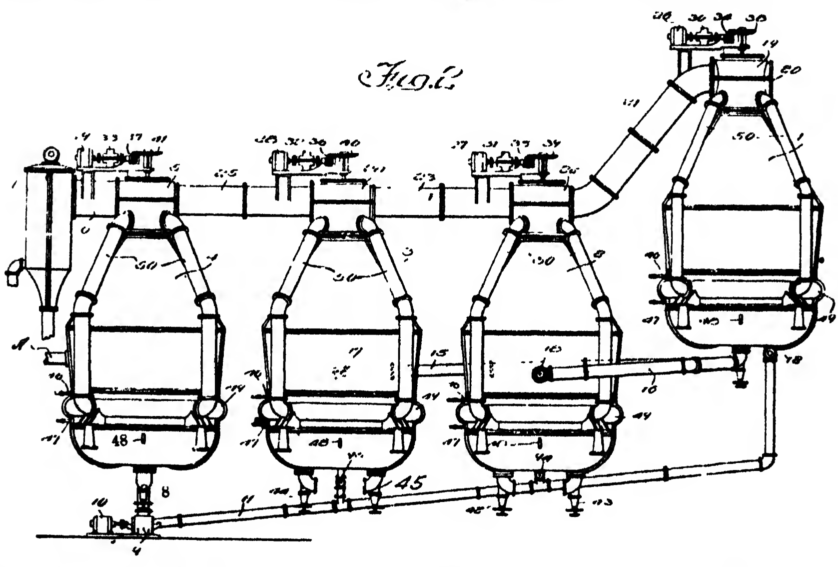
FILTERING LIQUIDS. **E. A. Alliott and Manlove Alliott & Co., Ltd.**, of Nottingham. (*A*) 338,510. (*B*) 338,567. August 15th, 1929. (*A*) Leaf filters are supported on a header within the casing so that they can be withdrawn as a unit from the casing after the door of the casing has been opened. The filtrate is discharged from the leaves through the header. (*B*) Each filter leaf has two or more outlet tubes extending through the upper end of the leaf, and having their inlet orifices at different levels within the leaf.—RECTIFYING ALCOHOL. **E. A. Barbet**, of Paris. 338,569. January 14th, 1931. In a process for obtaining concentrated alcohol from fermented wines, musts, etc., of the kind in which the wines are first distilled and then rectified, the heat of the vapours of distillation being used for the rectification, the heated wines after distillation are subjected to two successive rectifications, the second rectification being effected solely by the heat contained in the alcoholic vapours, and being carried out under vacuum if desired.—HARVESTING SUGAR CANE. **R. S. Falkiner and W. G. Charley,** of Melbourne, Australia. 339,618. September 10th, 1929. Relates to a disc cutter for the cane harvesting machine. It comprises a frame having an upper, an intermediate and a bottom plate, the three being rivetted, welded, or otherwise secured together, and the bottom one being of cambered or of conical formation. Knives are fitted between the plates.—HEATING FLUIDS BY ELECTRICITY. **R. A. Careton,** of Massachusetts, U.S.A. 339,649. September 10th, 1929. Relative to a fluid heater which may be used as a steam generator or super-heater in an evaporator for concentrating sugar juices and the like.—ANNEALING METALS AND OTHER MATERIALS. **Edward G. Herbert,** of West Didsbury, Manchester. 338,511. August 16th, 1929. A process for modifying the physical properties of metals and other substances, including quartz, sugar, and rock-salt, consists in subjecting the substances to the action of a concentrated locally generated magnetic field or like flux or vibration other than heat, the field, etc., having a relative movement with respect to the substances.

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

UNITED STATES.

CRYSTALLIZING SUGAR IN MULTIPLE EFFECT. **Joshua R. Ray and Thomas Ray,** of Manistree, Mich. 1,785,530. December 16th, 1930.

Liquid is pumped into the pan 4 by means of a pump (not shown) connected with the pipe *A* and evaporation of the liquids proceeds. The temperature of pan 4 is approximately 100°F. preferably. Considerable evaporation and heating of the liquid takes place in pan 4, but is insufficient to form crystals to any appreciable extent. When the liquid has become concentrated to the desired point in pan 4, the strike valve 8 is opened and the liquid pumped by means of pump 9 and motor 10 and pipe line 11 into pan 1. Valve 12 at the bottom of pan 1 is open during the pumping operation and is closed when the pan 1 is filled somewhat above the flue sheet. The temperature of the pan 1 is approximately 190°F. When crystallization has proceeded to the desired extent, strike valve 12 is opened and liquid from pan 4 is slowly and preferably continuously pumped into pan 1. The liquid is preferably kept slightly above saturation. Now crystals being thus formed continuously until pan is full. The liquid laden with minute sugar crystals is then withdrawn from pan 1 by a cut strike through pipe lines 15 and 16, respectively. Valve 17 adjacent pan 3 is opened as well as valve 18 adjacent pan 2. One-half of the liquid

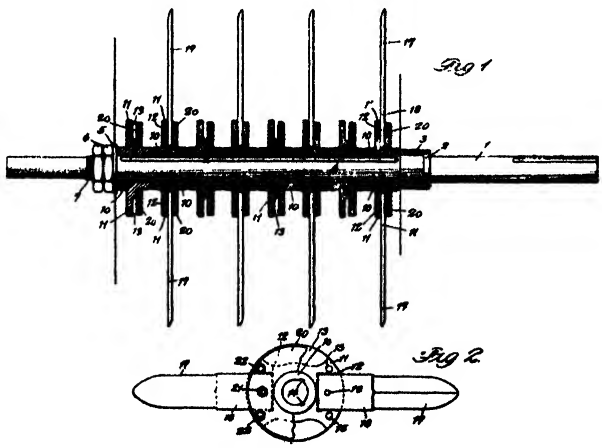


from pan 1 enters pan 3 while the other half from pan 1 enter pan 2. When pipe lines 15 and 16 are drained, valves 17 and 18 are closed. The process in pan 1 as above described is repeated with new liquid from pan 4. The liquid delivered to pans 2 and 3 now has minute crystals formed therein. The purpose of pans 2 and 3 is not to increase the number of crystals, but to build up the size of the crystals already formed in pan 1. All the pans of the quadruple are preferably furnished with circulators which are particularly effective in all of the pans. Fresh liquid from pan 4 is supplied preferably continuously through valves 94 and 95 in pans 2 and 3 respectively. The liquid in pans 2 and 3 is kept at or slightly below saturation preferably. When the crystals have reached the desired size, the contents of pan 3 are drawn off through strike valves 44 and 45, and the contents of pan 2 are drawn off through strike valves 41 and 43. It will be noted than pan 4 is operated countercurrent, serving to pre-heat and pre-evaporate the liquid, thereby preparing the liquid for the crystallization in pan 1. A superior grade of hard sugar can be made by this novel method, regardless of the temperature in the respective pans. The temperature in pans 1, 2, 3 and 4 is preferably in the neighbourhood of 190°, 160° 130° and 100°F. respectively. Due to the thorough circulation which is produced

by the pan construction and circulator therein, a high temperature in a pan to form a high grade of hard sugar is not necessary. The particular quadruple effect shown in the drawing operates satisfactorily (it is here said) with only 2 lbs. per sq. in. of steam applied to the calandria of pan No. 1, being therefore very economical in vapour consumption.

ROTARY CUTTER. **Alfred M. Simpson,** of Manila, P.I. 1,780,247. November 4th, 1930.

Referring to the drawings, 1 indicates a rotary shaft upon which the gang of cutters is rigidly mounted, said shaft having a flange 2 which is engaged by a collar 3, which constitutes one abutment for the gang of cutters, the opposite end of the shaft being provided with a washer 5 and lock nuts 6, 6 engaging threads 7 on the shaft, which constitute the other locking element. The shaft is provided with a longitudinal key-way 8, by which the individual cutters may be locked to the shaft. The cutter elements are identical in construction, each comprising a hub 10, provided with two key-ways 14, 14 spaced 90° apart in the interior of the hub, so that either of said key-ways may be brought into registry with the key-ways in the shaft and locked to the shaft when the key is driven home. The hub is provided with a peripheral flange 11 containing two knife receiving grooves 12, which are substantially rectangular and are disposed on diametrically opposite sides of the flange, but on the same face thereof. The intermediate portions of the same face of the flange are recessed, as at 13. As indicated, the grooves 12 are adapted to receive and retain the knives, each of which comprises a blade portion 17, which is preferably flat on one



face and oppositely bevelled on the other, and a butt portion 18, which is substantially quadrilateral and rectangular to fit in the grooves, the length of the butt being somewhat greater than the depth of the corresponding groove, so that the upper portion of each butt, when the latter is fitted in its groove or recess, extends a short distance beyond the adjacent face of the flange 11. A collar or washer 20 surrounds the hub section, and engages the faces of the butts of the knives, said collar being rigidly locked to the flange of the hub by bolts 22, preferably four in number, which engage registering openings in the flange 11 and the washer 20, the bolts, when set up, drawing the washer firmly into engagement with the butts of the knives. Preferably, each knife butt is provided with an opening 19 which registers with openings in the flange 10 and the collar 20 to receive a bolt 21, which insures the locking of the knife in its groove against any relative movements. The cutters, as described, are assembled on the shaft 1, in the manner shown in Fig. 1, with the knives on successive cutters disposed at right angles to each other, which relation is readily

effected by reason of the disposition of the key-ways 14, 14 in the hubs. As explained the blade of each knife is double edged, so that, when one edge becomes dull, the knife may be turned over to present the other edge to the material to be cut, and the cutting operation will be effective in re-sharpening the dulled edge.

PRODUCTION, APPLICATION AND REVIVIFICATION OF ACTIVATED (DECOLORIZING) CARBON. (*A*) **Millard Brandt** (assignor to **Darco Corporation,** of Wilmington, Del.). 1,781,314. November 11th, 1930. (*B*) **Johannes van Loon,** of Deventer, Holland. 1,782,493. November 25th, 1930. (*C*) **Rudolf Defris and Robert Wälder,** of Vienna. 1,783,110. November 25th, 1930. (*D*) **William A. Bender, Robt. Douglas, and Lowell H. Cuthbert** (assignors to **General Foods Corporation,** of New York). 1,787,467. January 6th, 1931. (*E*) **Leonard Wickenden and John J. Naugle,** of New York. 1,787,502. January 6th, 1931. (*F*) **Cornelis Lourens** (assignor to the **General Norit Co. Ltd.,** of Amsterdam). 1,788,466. January 13th, 1931.

(*A*) In the purification of water by activated carbon in a metal container, the improvement which comprises disposing the carbon in a pervious bed of highly activated, firm, electrically-conductive, oxygen-absorbing particles in said container and electrically insulating said container from said bed in such a way as to prevent the carbon from forming galvanic couples with oxidizable metals when the apparatus is in use thus to make oxygen adsorbed by the carbon available for reaction with impurities in the water. (*B*) A process of manufacturing decolorizing carbon comprising grinding carbon to a size not substantially greater than 2 to 9 μ in the presence of a liquid medium, but discontinuing the reduction in size at a point where the product is substantially non-colloidal, and separating the carbon and liquid medium after grinding. (*C*) A process for the production of activated carbon comprises forming filamentary passages in agglomerated finely divided carbonaceous material and thereafter treating the carbonaceous material to produce active carbon. (*D*) The process of decolorizing and deflavouring colloidal solutions comprises percolating the same through a mixture or medium of activated carbon and filter mass, the medium being of a coarse open texture and containing 50% or more of carbon, by weight, air-dry basis. (*E*) The method of treating a fluid having two or more types of impurities therein, which comprises adding to such a fluid subdivided carbonaceous adsorbent material of varied degrees of fineness one portion of which adsorbs one type of such impurities and another portion of which adsorbs another type of such impurities. (*F*) Claim is made for active carbon containing from 0·3 to 0·5 per cent. of acid.

BAGASSE UTILIZATION. (*A*) 1,780,750. **Harry L. Horn** (assignor to **Bagasse Development Inc.** of New York). November 4th, 1930. (*B*) **Eugenio A. Vazquez** (assignor to **Vazcane Process, Inc.,** of Delaware). 1,782,751. November 25th, 1930. (*C*) **Wm. L. S. Williams** (assignor to **Hawaiian Cane Products, Ltd.,** of Hilo, T.H.). 1,782,755. November 25th, 1930. (*D*) **Joaquin Julio de la Rosa** (assignor to **Bagasse Products Corporation,** of New York). 1,782,869. November 25th, 1930.

(*A*) A method for preparing cellulose pulp from cellulose bearing material such as bagasse, straws, grasses, wood, cornstalk and the like, consists in simultaneously cooking, beating and electrically and chemically treating the cellulose bearing material. (*B*) Claim is made for the cellulosic product comprising abraded sugarcane from which substantially all sugar has been removed. (*C*) A method of treating bagasse for the manufacture of wall-board and the like comprises separating fibrous from the pith portions, digesting the fibrous portion to produce a clear fibre, cooking the pith portion with water to effect the desired degree of hydration, and admixing the resultant stocks. (*D*) A method for recovering the fibrous material from sugar cane, which includes the step of treating the fibrous part of the cane with substantially neutral water at a temperature sufficient to remove or transform most of the substances combined with the fibrous part, said treatment being carried out in the substantial absence of air.

United States.

(Willett & Gray).

(Total of 2,240 lbs.)	1931 Tons.		1930 Tons.
Total Receipts, Jan. 1st to March 28th	617,501	..	508,652
Deliveries „ „ „	627,285	..	693,599
Meltings by Refiners „ „	547,609	..	683,941
Exports of Refined „ „	7,000	..	15,581
Importers' Stocks, March 28th	149,108	..	262,324
Total Stocks, „	314,560	..	421,576
	1930		1929
Total Consumption for twelve months	5,599,377	..	5,810,980

UNITED KINGDOM.

The Quarterly statement of Imports, Exports, and Consumption relating to the United Kingdom, derived from the Board of Trade statistics, which usually appears in our April issue, comes out too late this month, owing to the incidence of the Easter holidays, for us to be able to include it in this number.

Beet Crops of Europe.

F. O. Licht's First Estimate at March 31*st* 1931.

	1931-32. Hectares.		1930-31. Hectares.		1929-30. Hectares.
Germany	370,000	..	467,232	..	433,900
Czecho-Slovakia	190,000	..	237,038	..	227,258
Austria	42,000	..	35,674	..	29,687
Hungary	58,000	..	65,497	..	72,975
France	228,000	..	259,210	..	244,867
Belgium	50,000	..	55,567	..	57,194
Holland	40,000	..	57,462	..	55,002
Denmark	32,000	..	32,000	..	29,900
Sweden	33,000	..	36,723	..	27,449
Poland	152,000	..	177,348	..	242,040
Italy	107,000	..	112,125	..	116,111
Spain	85,000	..	91,000	..	88,050
Jugoslavia	39,000	..	46,885	..	61,558
Roumania	36,000	..	44,000	..	36,000
Bulgaria	16,000	..	21,500	..	18,135
Switzerland	1,500	..	1,500	..	2,000
Great Britain	115,000	..	139,240	..	92,221
Irish Free State	4,500	..	5,360	..	4,800
Other Countries	24,000	..	20,500	..	14,537
Europe without Russia	1,623,000	..	1,905,861	..	1,853,684
Russia	1,382,000	..	1,044,000	..	784,000
Europe including Russia	3,005,000	..	2,949,861	..	2,637,684

United Kingdom Monthly Sugar Report.

Our last report was dated March 11th. The markets generally have maintained a firm undertone and prices have gradually hardened.

Meetings have been taking place in Paris to fix the final details in regard to the Chadbourne plan and it is reported that the plan will be finally ratified by all parties concerned during the next fortnight.

The prevailing opinion that the plan would definitely be adopted has led to a general reserve on the part of the sellers, and buyers have found it difficult to operate without paying advancing prices.

The London Terminal Market has been steady and firm throughout the period under review. May has advanced from 6s. to 6s. 6d., August has been dealt in fairly extensively from 6s. 3d. to 6s. 9d., December moved from 6s. 7d. to 7s. 1½d., and March from 6s. 10½d. to 7s. 4½d. The latest prices are :—

MAY		AUGUST		DECEMBER		MARCH
6s. 6d.	..	6s. 9d.	..	7s. 1d.	..	7s. 4½d.

There has been a steady demand from the trade, who were generally short of stocks, and it has been accentuated by an extra demand because of the thought that the Chancellor might increase the duty on sugar in the coming Budget.

Refiners have registered a series of advances. 3d. per cwt. on the 19th March, 3d. on the 24th, 3d. on the 27th, 1½d. on the 30th and 1½d. on the 9th April. The Home Grown factories advanced their prices in sympathy. The latest prices are Tate No. 1 Cubes 24s. 6d., London Granulated 20s. 10½d.

There has been a considerable improvement in business in raws to the refiners, and they have bought considerable quantities of 96° Cubans, San Domingos, Perus, etc., from 6s. to 6s. 7½d. c.i.f.

The American Refiners also experienced a better demand and have bought Raws fairly extensively from Cuba, Porto Rico and Philippines up to a price of 1·38 c.i.f. New York.

A quantity of 15,000 tons Russian Crystals has been sold to Holland at a parity of 6s. 9d. c.i.f.

Mr. F. O. Licht has issued his first preliminary estimate of European Beet sowings, which he gives as a total reduction for Europe of 14·8 per cent., whilst he estimates Russia to be an increase of 30 per cent. This latter figure he gives, however, with the utmost reserve.

21, Mincing Lane,
London, E.C.3.
10th April, 1931.

Arthur B. Hodge,
Sugar Merchants & Brokers.

THE INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 389. MAY, 1931. VOL. XXXIII.

Notes and Comments.

The Brussels Convention of 1931.

As we write these notes we learn that the ratification of the sugar restriction scheme associated with Mr. CHADBOURNE is an accomplished fact, the signatures of the participants having been appended at Brussels on May 9th. This concludes fittingly the labours of a series of negotiations extending over the last eight months.

To Mr. CHADBOURNE is due the credit for having stepped in when Cuba had previously failed with her solitary restriction schemes, and brought the restriction aspirants of the West in touch with those of Europe and the East. It needed a strong personality to induce so many diverse elements in the world sugar industry to meet in conference, and CHADBOURNE, representing as he did the financial interests of U.S.A. and Canada in Cuban sugar industry, had sufficient backing and sufficient force of character to secure that his scheme was given adequate consideration. But once the conference was got to assemble and the scheme unfolded, it is to the credit of the other parties that they recognized its virtues even if they did not ignore its dangers. The Dutch East Indian interests, whose participation was a *sine qua non*, ceased their policy of aloofness and entered wholeheartedly into the task of shaping the new agreement to suit the divergent interests. Parenthetically, it may be observed here that in all probability India has unconsciously played a larger share in shaping the destiny of the agreement than might have been supposed, since her recent decision to protect her sugar industry by increased import duties, and thus ultimately to dispense with Java's contribution of a round million tons of sugar, must have played no small part in convincing the Java sugar interests that restriction of output was inevitable if the situation was to be saved. Be this as it may, the heads of the Java industry in Holland, in particular Dr. C. J. K. VAN AALST, once convinced of the feasibility of the CHADBOURNE proposals, worked with a will to secure Java's participation, and in spite of considerable opposition from certain quarters succeeded in getting 80 per cent. of the Java producers on their side and assuring Government co-operation. As for the European beet sugar participants, Germany, Czecho-slovakia, Poland, Hungary, and Belgium (the principal exporters of beet sugar to free markets), they one and all exhibited a keen desire to see a successful outcome of the negotiations, so where the will was present it was not difficult to adjust differences of opinion as to apportionments by friendly compromise. The worst hitch was possibly that connected with Germany's

insistence on a larger export allowance than had been provisionally offered her. The final concession made her was chiefly at the expense of Cuba; but as things have shaped Germany, curiously enough, has since found herself unable to bear the financial loss on so big an export quota as she was granted, so in the end Cuba gets back nearly all she conceded.

With the ratification of this pact, it will cease officially to be known as the CHADBOURNE scheme, and we understand will be referred to as the "Brussels Sugar Convention of 1931." We had hoped to be able in this number to reproduce in full the Articles, giving the terms, stipulations and definitions; but it was decided at the last moment to withhold publication for the present, and to release only a summary, which we reproduce on another page.

The Price Factor in the Agreement.

Since the object of the restriction pact is to ensure a return as speedily as possible to an even balance between Supply and Demand, it has been necessary to make arrangements for counteracting any excessive rise in price such as would encourage increased production, particularly amongst producers outside the agreement. The final stages of negotiation were therefore devoted to a discussion of the most suitable price level at which extra sugar could be released from segregation. Java was in favour of 2 cents while Cuba naturally inclined to 2½ cents. In the end it was decided that in the event of the world price of raw 96° sugar averaging, over 30 consecutive market days, the equivalent of 2 cents per lb., f.o.b. Cuba, the export quotas of each country are to be increased by 5 per cent., that is by 225,000 tons. If the price for the same prescribed period reaches 2¼ cents, the International Sugar Council may at its discretion but without obligation increase the export quotas by an additional 2½ per cent. If however a price of 2½ cents is reached the Council must increase the quotas by a further 5 per cent. (less the aforesaid 2½ per cent. if that has already been conceded). A variation is allowed in the case of Java, due to the fact that market conditions in the far East are not always directly influenced by free market conditions in the West: if she succeeds in selling 400,000 tons of Java white sugars at the parity of 12 guilders per 100 kg., ex warehouse Java, before the 2-cents world price has been reached, this will automatically increase the quotas by 5 per cent., while similar sales at 13½ guilders and 15 guilders will have the same effect on the quotas as prices of 2¼ and 2½ cents respectively, as outlined above. It should be added that only one increase of 5 per cent. covering a 2 cent price is to be permitted in each calendar year, and the additional releases shall not exceed in the aggregate another 5 per cent., so that the total increase of quota in any one year will apparently not exceed 10 per cent., or say 450,000 tons

The work of supervising the operations of the agreement is to be vested in an International Sugar Council with its headquarters at the Hague. It is to be under the chairmanship of an American, Mr. FRANCIS E. POWELL, late president of the Anglo-American Oil Company and President of the American Chamber of Commerce in London. Each country will be represented in the Council by three members; but the number of votes of the respective countries varies, Cuba receiving 35, Java 30 and the European members from 6 to 2 each. By this apportionment of votes the European beet countries, as LICHT points out, will always be the decisive factor in case of differences between Cuba and Java, but no single group of votes (Cuba, Java, or Europe) will ever alone be able to command a decision.

Effects of the Agreement.

The sugar market has been prepared for some months for the pending change. But while at the outset some nervousness was displayed, this soon gave way to scepticism as to any agreement amongst the participants being possible. More recently when it was seen that these participants meant business and that the completion of the agreement was a virtual certainty, a spirit of "defeatism" took the place of scepticism in those circles (predominantly American) that were opposed to any interference with the right to buy sugar at the cheapest price normality or abnormality chanced to offer. This hostility is the more easily persisted in, in that world markets generally are more susceptible nowadays to pessimistic influences than was the case in pre-war days. This is the reign of the "bears." The trend of sugar markets since the war has been one of two opposite extremes. First came the immediate post-war years when a fear of shortage sent the price of sugar up in 1920 to its record of 22½ cents; during these years the invisible supplies were steadily built up and it seems evident that this process was mistaken unduly for an increase in the consumption and so gave ill-advised encouragement to increased production. Once the rate of stocking invisibles slackened off, prices took a steadily downward tendency, the repercussion of which developed an entirely opposite trend in the market. Thenceforward there was no incentive to stock and a habit started and took firm root of cutting down invisibles to a minimum, and instead of the surplus stocks being spread fragmentarily throughout the trade and amongst the consumers, they have been left in the hands of a comparatively small number of sugar producers; hence the market has remained for several years past a buyer's and not a seller's domain. LAMBORN of New York has ventured lately on the difficult task of estimating the quantitative extent of invisible supplies. It is obviously a matter of observation and conjecture; no specific data are available. LAMBORN opines that these supplies may vary from 3,000,0000 tons in times of distress, over-production and declining prices, to possibly as high as 10,000,000 tons when there is a period of confidence and advancing prices. Possibly 6,500,000 tons might be taken as the figure at which invisible stocks exist under average market conditions. What seems clear in the view of market observers is that invisibles must now be abnormally low. So unless the consuming world is content to persist with hand-to-mouth conditions, with their risks of being caught on a rising market, there is every inducement, in the changed conditions envisaged by the CHADBOURNE agreement, to increase the invisible stocks to a more normal figure.

But for the time being the "bears" have dug themselves in, and New York, their headquarters, has been encouraged in its resistance by the fact that the Philippines have made it a present of the whole of its current crop at to-day's prices. So there is no material improvement in the market for the time being, and indications point to the possibility that several more months will elapse before certain inexorable factors have full play on market prices. These include: (1) the fact that nearly three million tons of surplus sugar out of an annual production of 28 millions is being taken off the market[1]; (2) that the Cuban crop is now coming to an end so that storage congestion in Cuba will tend to easen and there will be no need to throw Cuban sugars on the American market at cut prices: (3) that the European beet crop (bar Russia) to be marketed next Autumn and Winter promises to be appreciably less, not only

[1] These three million tons are roughly reckoned to be apportioned as follows: Java 600,000 tons plus the excess in her 1931 crop already planted; Cuba 1,040,000 tons; Germany 628,000 tons; Czecho-Slovakia 290,000 tons Poland 220,000 tons; Hungary 55,000 tons; and Belgium 80,000 tons.

on account of reduced sowings but from the fact that last year's favourable weather and much more than average yield cannot be counted on to repeat themselves. Other less immediate factors encouraging a rise in price are: Supplies available during the next five years from the participants in the agreement can be calculated with reasonable accuracy; any encouragement to outsiders to increase their production, in so far as it is engendered by high prices, should be greatly retarded if not wholly prevented by the plan to release additional amounts from the segregated quotas when prices rise above what has been fixed as their basic level. All these factors as they come into play will influence the market with progressive force, and a real step will have been taken towards correcting the statistical balance between supply and demand which is bound to restore prices again to a more economic level. Once the vicious circle is broken, prices indeed may not stop there. Any return to abnormal prices is not desirable on account of its repercussion on production; but when we consider the scope for absorption that lies in the possible range of invisibles, as conjectured above, a tide might run that could not be stemmed by any quota releases.

Still for the moment it has to be admitted that consumption is under the cloud of world depression and lack of employment which seems to be a feature of nearly every staple industry; and a decrease instead of an increase may quite possibly mark the figures of the calendar year 1931. In the United States, consumption for the first quarter has not been up to anticipations, deliveries having been about 16 per cent. less than in the same period of 1930. In the Far East there is little or no sign of a cessation of the unrest that hampers trading operations. Still sugar is a food not a luxury and a very cheap food nowadays, so it is not to be expected that fluctuations in the demand will be more than fractional in the long run.

The German Export Quota.

"The Economic Union of the German Sugar Industry," a project devised to bring the German sugar producers under one control, has at length been brought into being, and is to last at least till September 30th, 1935. It will simplify the operation in that country of the provisions of the Brussels agreement. LICHT reports that the Export Association, which we assume will work under the Economic Union, has decided that the German surplus of sugar arising out of the 1930-31 campaign shall amount to 43 per cent. of the production, which was 2,511,000 tons. Of this, 25 per cent., viz., 628,000 tons, is to be segregated, and 18 per cent. or 452,000 tons is available for export. The net export is however less by 87,000 tons, the quantity of sugar going into feeding stuffs or the like (which must be treated on a par with exports), so that the total export will be 365,000 tons net or 135,000 tons less than the 500,000 which the German delegates to Brussels accepted as a compromise last January. This deficit of 135,000 tons will be divided amongst the other participants to the Convention, Cuba being entitled to 575/750ths, or about 103,000 tons.

Mr. Chadbourne's View of the Achievement.

F. O. LICHT reproduced in his Monthly Report a telegram sent by Mr. CHADBOURNE to President MACHADO after the final session of the last Paris Conference. It summarizes fairly well the moral achievement of the long series of conferences which have culminated in the signing of the pact, so we think it may fittingly find a place here.

"The plan is unique among all similar undertakings in that it has received, or will receive, the support of the governments of all the countries con-

cerned. The governments have undertaken to protect, by a system of export licenses, the integrity of the export restrictions agreed upon under the plan. There is no geographical restriction of markets and fixing of prices.

"If the statistical position of world sugar production and consumption admits, the price can easily go beyond the two cents at which export quotas will be increased, and approximate $2\frac{1}{2}$ cents, which will enable the Cuban industry at least to regain its cost of production, including interest on the investment. Without such an agreement, protected as this one will be by the action of the governments involved, enormous over-supplies of sugar in the world would have been found over the market and depressed the prices for at least several years to come.

"As it is now, under the operation of this agreement, through the curtailment of unnecessary production and the restriction of exports, there is every reason why the sugar market should become orderly once more, thus reflecting the restoration of equilibrium between world production and consumption. The restriction planned protects producers the world over and the arrangement for the increase of export quotas is at once a protection to consumers against abnormal prices and a protection to producers against the encouragement of unnecessary producing capacity in countries not parties to the agreement. The consummation of this agreement has, of course, involved great sacrifices on Cuba's part.

"I wish to call attention, however, to the fact that all the countries participating in the plan have also agreed to very important concessions. The difficulty of securing agreements on all sides to the necessary sacrifice accounts for the delay in reaching a final agreement. This plan, as now arranged, is in the interest of every one and the possible gains from it are immeasurable in proportion to the sacrifices made. That is the point of greatest importance to Cuba. The agreement registers the first occasion upon which all important exporting countries have united in a common effort to promote the general interests of the world sugar industry."

The United Kingdom Budget.

In the six months that have elapsed since we last referred to the state of politics in the United Kingdom, the Labour Government has had its vicissitudes, but it has preferred to continue what the *Times* aptly terms a "companionate marriage" with the Liberal party rather than court disaster to its term of office by legislating for "socialism in our time." As a consequence, the edge of its legislative sword has been blunted and what new law making has been attempted cuts little ice with the extremer elements in the Labour party, being designed more to keep the Liberals contented with their present lot till a possible new opportunity presents itself. Hence, while discontent coupled with threats is ever and anon present in the Labour party, it does not attain the courage of an adverse vote, so the Conservatives (whose overwhelming desire is to come to the aid of the depleted industries of this country by means of a considered tariff on imported manufactures) have failed so far to breach the wall of the Government's joint majority of Labourites and Liberals.

The trade unions having for long accustomed themselves to protection in respect of hours and wages are becoming increasingly reconciled to the idea of a tariff against imports. But any representations they may have made in favour of the idea meet with no sympathy from so orthodox a free-trader as Mr. SNOWDEN, the Chancellor of the Exchequer, and he is easily the most

powerful man in the present Government so far as fiscal ideas are concerned. He unfolded his second Budget proposals at the end of last month, which merely revealed the paucity of the free-trader's resources for dealing with the present desperate trade depression in which the country finds itself. Mr. SNOWDEN declared that he would never be a party to a revenue tariff or anything like it. Yet he had nothing tangible to offer in its place; he can only mark time in the hope that trade may revive ere worse befalls, and meantime he does some juggling with monetary reserves and with income tax payments in the faint hope that they will suffice to balance the present year's accounts. Certainly he does not attempt any heavy new taxation; he considers reasonably enough that the country could not stand it—and the Liberals would not. Hence the only new tax he can suggest is a small extra impost on petrol.

Mr. CHAMBERLAIN, speaking for the Conservatives, suggested that Mr. SNOWDEN could equally well have chosen sugar for his purpose. It would go no further than the petrol tax in increasing the cost of living or adding burdens on industry. To put a small extra impost on foreign sugar would have helped to place the sugar colonies of Mauritius and the West Indies on their feet, as well as bring in the additional revenue required. To the orthodox free-trader, however, these incidental aids to industry are anathema, so Mr. SNOWDEN carefully avoids them. Indeed, there is not a single new item in his 1931 Budget calculated to relieve industry and unemployment; and there are not wanting observers who predict that this will be the last Free Trade Budget the House of Commons listens to. Before the next one is due, the problem of unemployment will have to be tackled by the Government, who are ostensibly waiting for the report of a Commission on the subject. The conclusions of the latter, whichever way they point, are almost certain to lead to political strife if not to party cleavages, and it may be on this rock that the present Government will founder.

The British Sugar Beet Society.

The British Sugar Beet Society in their report for the year 1930-31 can point with satisfaction to a crop of record proportions. Some 348,000 acres of roots were grown, as compared with 232,000 acres in 1929, while the output of sugar has been about 420,000 tons, which compares with 290,000 tons in 1929-30. But the average tonnage of roots per acre remains somewhat disappointing, being no more than 8¾ tons. The Society expresses the view that "the very good results obtained by so many growers in all districts seem to indicate that the majority of farmers do not take the trouble to understand the requirements of the crop." This somewhat sharp criticism may be justified, but it must be added that there are some critics of the Society's dictum who explain the lack of better results as due to the large number of newcomers to this form of agriculture who have not as yet acquired the full technique of cultivation, also to the fact that some of the land on which beets have been grown is not altogether suitable for the purpose. Yet when all allowance is made for these drawbacks, the disparity between an average of 8¾ tons and the 17 tons or more that the best growers have achieved is wide enough to warrant the belief that the Society is justified in indulging in criticism. The winner of the Mason Challenge Cup this year achieved a crop of 21·01 tons per acre with 16·88 sugar content, while the second and third competitors had, respectively, 18·4 tons with 18·23 per cent., and 19·9 tons with 16·60 per cent. sugar content. These, it is true, were not for large acreages, but the best competitor for an output of 20 or more acres obtained a crop of over

40 acres, yielding 17·5 tons and a sugar content of 17·1 per cent. Another secured 15·44 tons per acre with 16·8 sugar content from 148 acres.

The present season, unfortunately, promises a setback for the Beet Society's interests. The reduction in the beet subsidy to its lowest third of 6s. 6d. per cwt. this season precipitated a crisis in the negotiations between the factories and the growers as to the price to be paid for the 1931 beet; and as stated in our March issue, it was only settled by means of an offer of further Government assistance contingent on the price of raw sugar not rising above a certain agreed figure. Thanks to this offer, twelve of the factories were able to make terms with their farmers; the Anglo-Dutch group have however stuck out for a plan whereby the farmers take the risks and chances of profits. This group have announced in the press that they have had enough offers to warrant their running all their factories. But last year's record acreage in England is not going to be repeated, since a considerable number of dissatisfied growers will drop out. Various estimates, ranging between 15 and 30 per cent., are talked of as the amount of the decrease. What is unfortunate for the beet sugar producers in this country is that this first year of a further reduced subsidy coincides with a price level of unprecedented depression; that is the main obstacle to continued expansion. But taking the international view, it is perhaps just as well that the United Kingdom should not be able to register in 1931-32 a further increase in output when other countries are making a stern endeavour to cut production figures down to the level of indicated consumption.

Trinidad College of Tropical Agriculture, 1929-30.

The Report of Mr. Geoffrey Evans, the Principal of the Imperial College of Tropical Agriculture at Trinidad, for the academic year 1929-30, as lately issued by the Governing Body, records further substantial progress. During the year 49 students were in residence, including 19 post-graduates nominated by the Colonial Secretary under a plan for training officers for the Colonial Agricultural Service. Research was confined to four main crops, sugar cane, cacao, bananas and citrus.

Twenty-one students attended the Diploma courses, but these being spread amongst the various classes the latter were necessarily very small. Thus three students in the third year class took sugar technology and one man in the fourth year. Consequently, the cost of training is correspondingly high, for the same teaching staff has to be maintained and the same course of lectures delivered whether the classes consist of two men or of twenty. The sugar technology course in particular is proving expensive; last year there were five students in all taking it, and the experimental sugar factory had to be operated specially for their benefit. The widespread depression in sugar in particular and agricultural industry in general is not at present encouraging the young men of the West Indies to engage in agriculture, and they seem to prefer seeking a training in legal, medical or other professions, or in the oil industry.

The working of the experimental sugar factory was severely handicapped by the fact that Professor Scott met with a serious motor accident just before operations were due to start, and was incapacitated from any further work during the year. This necessitated a complete rearrangement of the programme of the factory; the research work had to be reduced to a minimum and the factory was run purely for instructional purposes so as to afford the sugar technology students the necessary training. Grinding operations commenced on March 18th and were completed on April 10th. Various

grades of sugar were successfully made and afforded excellent training for the students. The canes were supplied by the Government stock farm, the College estate, and a small quantity from some experimental plots of the Froghopper Committee. The crop made was smaller than usual, being some 55 tons of sugar; but the cane was particularly good and only 9·12 tons was required to the ton of sugar, which was the best the factory has hitherto achieved.

British Colonial Sugar Crop Reports.

From Barclay's Bank (D.C. & O.) Monthly Review we compile the following information on current conditions in the British sugar colonies: *Mauritius.*—Till mid-February weather conditions were favourable for the standing sugar crop which promised well; but the severe cyclone of March 5th which swept the island for three days caused considerable damage to property and to the canefields. The loss suffered by the sugar industry, including the damage to factories, growing crops, etc., is put at £700,000 and the mid-April estimates of this season's crop do not exceed 175,000 to 180,000 tons. This disaster has greatly affected the poorer section of the community. *Barbados.*—The weather has remained dry during the past quarter and the much needed rain did not come. As a consequence the returns of the current crop are disappointing, the tonnage of cane being generally low and the recovery figure below estimates. A very short crop, possibly below 50,000 tons, appears to be inevitable. The new canes are looking well, but need rain badly. *Trinidad.*—Weather conditions have been favourable, with showers in the southern part of the island. Satisfactory progress has been made with the current sugar crop at all the sugar factories, and in some cases original estimates of output have been exceeded, due in the main to increased crops on the estates. Improvement is shown in the quality of the juice, and the total crop is expected to be well up to the average. As a result of the Local Government advances under the Sugar Relief Ordinance, there appears to have been no curtailment of the re-planting for the 1932 crop. During 1930 the exports of sugar amounted to 69,138 tons and the total crop to 79,848 tons, as compared with 81,501 tons and 89,926 tons in 1929. *Jamaica.*—Good rains have fallen throughout the island during the past quarter, and have been beneficial to the growing crops. But owing to the backward growth of the canes in the Trelawny district as a result of the drought last year, and to the unfavourable conditions in other areas, the total sugar crop now being reaped is expected to be only about 55,600 tons, which is some 18 per cent. less than last season's out-turn of 67,847 tons. The Imperial Government having approved the suspension of the payment of the Colony's War subvention of £60,000 for the year 1931-32, this sum will be devoted to assisting the local sugar industry. *Leeward Islands.*—Drought has prevailed throughout the Leeward group for the last three months and the crops have suffered severely in consequence. The sugar crop in St. Kitts is not expected to exceed 14,000 tons, which compares with 18,680 tons in 1930. *British Guiana.*—The 1930 crop in this colony has been a record, totally about 126,000 tons. The weather since January has been seasonably dry, but with occasional showers which have been welcomed by the planters.

TRINIDAD SUGAR ESTATES.—The last annual report of the Trinidad Sugar Estates Ltd., stated that 59,060 tons of cane were dealt with, yielding 7552 tons of sugar. The net profits were only £315, as compared with £10,006 in the preceding year.

Report of the Indian Tariff Board on the Sugar Industry, 1931.[1]

This small and handy volume of 120 pages contains the most exhaustive summary of the economic structure of the Indian sugar industry that has as yet been published : it may, in a sense, be taken as a supplement to the monumental Report of the Sugar Committee of 1920, verifying and, in places, modifying the conclusions arrived at then. It is divided into eight chapters as follows : The World Position, The Indian Sugar Industry, Conditions of the Fiscal Commission, The Problems Stated, Costs and Fair Selling Price of White Sugar, Import Prices and Method and Amount of Protection, The Consumer, Other Measures of Assistance. Then follow a summary of conclusions and a series of appendices, containing among other things comparative data as to costs of production in white sugar factories in Java and India. As the Report is closely argued throughout, an analysis in a short article is impossible, and this will not be attempted here, but rather an endeavour to place before the readers of this Journal the main facts of the case as disclosed, and the conclusions arrived at.

There are many apparent contradictions in the Indian sugar industry. It is far the oldest in the world and is generally considered the most backward : kept back in its development by age-long vested interests. And yet the impure mixture, gur, which is the main product, is probably a much better food for the people than the shining white crystals aimed at elsewhere. India extends 2000 miles north and south, from the tropical heat of Madras to the frosts in winter in the Punjab, and the sugar industry pervades the whole, from south to north and east to west. And yet the area under cane, in that part of India where thick tropical canes can be grown as well as anywhere else in the world, is comparatively insignificant; while in the north, where only thin rapidly maturing indigenous kinds can be grown in a growing season of less than half the year, lies the main sugar tract. Attempts to make white sugar have been made in India more or less for a century, but it was only when the indigo industry of Bihar was ruined by the synthetic product, that any permanent foothold was established. Now that it is, the total output is under 100,000 tons a year, whereas a million tons of white sugar are imported from Java in a year, in spite of a steadily increasing import duty. It is surely anomalous that a country with nearly 3 million acres under sugar cane should be in this position ; but this is explained by another paradox, for India, with the cheapest labour in the world, is no more able to enter the world market for sugar than Queensland with the dearest.

The following summary of the Indian sugar industry is drawn from Chapter II :—There are three distinct products of the sugar cane of economic importance in India at the moment : gur, *bel* sugar and white sugar. The manufacture of gur is a very simple process, and is a typical peasant industry almost throughout the country, the annual production being between 2½ and 3 million tons, according to the seasonal rains and price fluctuations. The cane is crushed in three-roller mills usually turned by bullocks, though more or less satisfactory small power mills have been devised and their use is spreading. The expressed juice is carried by hand to jars or tins to the open boiling pan and heated till it begins to solidify. As the boiling proceeds, the scum is removed, and various clarifying agents are introduced. When the juice is beginning to solidify it is rapidly stirred until the required consistency is reached ; it is then run off into wooden moulds or earthenware vessels, and

[1] Government of India, Central Publications Branch, Calcutta, 1931. Price Re. 1 or 1s. 9d.

allowed to harden. Undoubtedly this method is wasteful as far as the sugar content of the cane is concerned : only one crushing leaves much juice in bagasse, and inversion goes on rapidly during the boiling. The sucrose content of gur lies between 65 and 75 per cent., as against 99 to 100 per cent. in white sugar. But this inversion is only of importance when the gur is used as a raw material for refining to white sugar, which, as we shall see, is condemned in the Report. Comprehensive data are given as to the relative extraction and costs of production of small power and bullock-turned mills. The comparative extraction in such mills is given as about 68 per cent. to 62, and the cost in the principal sugar tract is about halved. But it is doubtful how far the power mills can be established among the cultivators as a whole, with their small and scattered plots of cane.

The *bel* industry, including the making of *rab*, may be regarded as the limit which can be reached by the purely indigenous methods. It is an attempt at making a product more on a level with white sugar, and is typically developed in the Rohilkhand division of the United Provinces, where 200,000 to 250,000 tons of this sugar are prepared annually. The process is thus described in the Sugar Committee's Report : The juice is boiled down in a series of five pans arranged in the form of a cascade, and diminishing in diameter and depth from above downwards. Such a "bel" would need 8 or 9 bullock mills to keep it supplied with juice, working 10 hours a day. In the first pan the juice is merely heated; in the second and third it is also clarified, sodium carbonate and the juice of bhindi (*Hibiscus esculentus*) being added; it is concentrated to a syrup in the third and fourth pans, and in the last pan it is boiled down to the final product—*rab*. The scum is removed by perforated iron ladles and strained through muslin and the juice returned to the pans. The hot massecuite is run into a series of small earthenware coolers, in which it is kept in violent motion until crystallization commences ; and it is then poured into spherical earthenware vessels, holding approximately 120 lbs. each. These are stored for 3 to 4 months and then sold to the small local "refineries." Here the pots are broken and the contents are placed in bags, stacked in piles of twelve, and pressed down by the feet; the molasses exudes and is run off in small drains for about 8 hours; and then the product is removed from the bags and to another room where it is stacked to a depth of 3-4 ft. on bamboos and cotton stalks. Here it is covered by a layer of water weed called *siwar* (*Vallisneria spiralis* ?), which is removed on alternate days. After a month's treatment in this way, the uppermost layer has been bleached and is scraped off, the process of covering with *siwar* and scraping being repeated on alternate days: each of the succeeding layers removed is darker in colour and less valuable than the one above it.

This process is crude and wasteful, the "white sugar" obtained being estimated as 4 per cent. on the cane used. But since 1920 this interesting method of treating the *rab* has been improved by the introduction of centrifugals in the refineries—raising the recovery to 5·25 per cent. on cane. In addition, a good second class gur is manufactured from the second massecuite, and the following figures are obtained : white sugar 5·25 + gur 3·58 + molasses 2·64 = 11·48 per cent. on cane, which compares not so unfavourably with an ordinary factory in North India : white sugar 9 + molasses 4 = 13 per cent. on cane. For this and other reasons, the Tariff Board reverses the condemnation of the *bel* process by the Sugar Committee. The factories are on a small scale and the overhead charges are also small; they can be quickly installed and can be operated in the interior parts of the country, where the

scattered nature of the fields and the absence of communications are at present unfavourable to the erection of factories. The Local Government considers that, during the period of transition, such "Khandsari" factories are, besides being the mainstay of the cultivators in an important tract of country, essential to the development of the sugar industry; and, undoubtedly, they will play an important part in providing an outlet for the threatened surplus of cane to be referred to later.

White sugar is made, both by refining gur, and direct from the cane as elsewhere. Gur is refined in 14 factories (besides others in part). The business is highly speculative, as it depends on the relative prices of gur and sugar, which by no means move on parallel lines; its interests are, moreover, against those of the gur producers, and it is thoroughly uneconomic, with a recovery of 5·5 per cent. of sugar on cane against over 9 per cent. in the white sugar factories. The out-turn in 1923-24 was 59,555 tons of sugar and this was fairly maintained for about four years, but is now rapidly declining. The Tariff Board is strongly against any measures for the continuance of this industry.

There are 29 white sugar factories in India, 28 of which were worked in 1929-30, producing 89,000 tons of sugar, of which 80,000 were obtained in North India. A Table shows a steady rise from 1921-22 when under 30,000 tons were manufactured. The average extraction has risen from 6·85 per cent. when the Sugar Committee's Report was written to 9·07 per cent. in 1929-30, which sufficiently indicates a real advance in factory control during the ten years which was criticized by the Committee. This, by the way, is not far behind the recovery from similar canes in Java factories.

Before proceeding to the problems to be solved by the Tariff Board, two aspects of economic importance in cane cultivation are referred to. The first is the status of this cultivation as regards the general well being of the cultivators. The area under sugar canes is slightly under three million acres, and has varied little during the past 20 years, nine-tenths of it being in North India and more than half in the United Provinces and Bihar: what follows refers in the main to the latter tract, in which alone the Board is able to suggest any important increase in the white sugar industry. Sugar cane in this area is a valued crop in the customary rotations, as it has been found that other crops succeeding it usually give increased yields: it also provides a considerable amount of fodder for cattle (in a part of the country where there are practically no pastures), and it also provides employment for men and cattle in the off season, between the main *kharif* and *rabi* crops. Furthermore, while the world slump in prices has had its effect on those crops in India whose produce is exported, it has had very little if any effect on the price of gur: jute, wheat, cotton and rice have declined in the last two years round about 50 per cent. each in value. Thus, sugar cane remains the one source from which the cultivator may hope to pay his rent and provide the necessaries of life for which cash has to be paid. The cultivation of cane becomes, in short, of national importance.

The second aspect concerns the out-turn of the cane fields, and is by no means so reassuring. The canes grown are undergoing a remarkable change in the main sugar tract in North India (to which the Punjab might be added in this respect, with over half a million acres of cane), owing in the main to the new varieties produced at the Coimbatore Sugar Station: the Tariff Board records a warm appreciation of the value of the work done there. This station was founded in 1912 and most of the new canes were produced in the first

seven years of its existence : their appreciation in North India has, from the nature of the case, been slow, but is now rapidly increasing, as shown by the acreage in the North of India during the last three years : 219,000, 363,000, 877,000. Of this last figure 700,000 lie in the United Provinces and Bihar (with 1,644,000 acres under cane); and the Board anticipates that within three years practically the whole of the indigenous canes in this tract will be replaced by the new varieties. This change, moreover, has been brought about without any material increase in the areas cultivated or in the costs of cultivation ; and it is estimated by the Directors of Agriculture concerned that the increase in yield of gur has been at least 50 per cent. There has as yet been no definite fall in the price of gur, although it must undoubtedly set in soon. The Board is obviously impressed with the results thus far obtained through research ; and it recommends that the facilities for this should be greatly increased at once—the main objective being, as heretofore, lessening the cost of the production in the cane fields.

With these data before us, we can envisage the main problems with which the Tariff Board is faced, and we can only give the barest outlines of these and the methods by which they propose to deal with them. Considering that the cultivation of sugar cane is a matter of national importance to India, the main problem is to find an outlet for the impending glut of canes to be milled, and the consequent menace to the whole Indian sugar industry. Encouragement is suggested to the consumption of gur, but this strikes one as rather vague and unconvincing, unless the current price is considerably reduced. The *bel* industry must be fostered and extended, both for the very existence of the large tract of country where it prevails, and to act as a natural stepping stone to an extension there for an up-to-date white sugar industry in due course. And every encouragement must be given to a wide extension of the white sugar industry over the part of the country where it has obtained a foothold. And only by these means can the wanted outlet of the threatened surplus be obtained. It is therefore necessary, at the earliest possible date, to make such protective arrangements, as will discourage Java from sending her surplus sugar to India : this million tons of sugar now imported is the trump card held by the Tariff Board for its recommendation of an increased protective duty.

There are many other matters of the greatest interest in this Report, chiefly dealing with the purely economic side. Such are[1] : the current cost of making, gur, refined *rab*, and white sugar in India, as compared with that at which these or similar products can be landed by Java in Calcutta ; a fair price that should be paid to the cultivator by the factories for his canes ; a fair selling price for the Indian sugar products named ; the amount of protection needed, and a comparison with that in other countries which have an indigenous industry to protect ; the comparative cost of research in India and in other cane growing countries ; the methods by which the cost of production can be reduced, and the status of the Indian sugar industry be gradually raised, so that when the present crisis in the world industry has passed and prices improve, India may be more able to maintain its independence of the world's markets. The period of protection is fixed at 15 years, being higher in the first seven years, so that the extension of the *rab* and white sugar industries may be stimulated in the near future ; the amount of protection recommended is not greater than that already existing in other sugar producing countries.

C.A.B.

---

[1] See *I.S.J.*, 1931, 156.

Exportation allowed under the Chadbourne Scheme.

(From C. Czarnikow's "Weekly Price Current.")

		1st Year		2nd Year		3rd Year		4th Year		5th Year
Cuba—										
Production (Jan./Dec.)	..	3,122,000	..	3,495,000	..	3,545,000	..	3,545,000	..	3,545,000
Drawn from quantity segregated	..	260,000	..	260,000	..	260,000	..	260,000	..	260,000
		3,382,000	..	3,755,000	..	3,805,000	..	3,805,000	..	3,805,000
Less Cuban Consumption	..	150,000	..	150,000	..	150,000	..	150,000	..	150,000
For Export	..	3,232,000	..	3,605,000	..	3,655,000	..	3,655,000	..	3,655,000
	1931		1932		1933		1934		1935	
Of which Export to U.S.	2,577,000	..	2,800,000	..	2,800,000	..	2,800,000	..	2,800,000	..
Export to Countries outside U.S.	655,000	..	805,000	..	855,000	..	855,000	..	855,000	..
Java—										
Exports (April/March)	2,200,000	..	2,200,000	..	2,200,000	..	2,200,000	..	2,200,000	..
Plus cumulative increase of 100,000 tons per year after first year	—	..	100,000	..	200,000	..	300,000	..	400,000	..
Drawn from quantity segregated	100,000	1931-32	100,000	1932-33	100,000	1933-34	100,000	1934-35	100,000	1935-36
		2,300,000		2,400,000		2,500,000		2,600,000		2,700,000
		1930-31		1931-32		1932-33		1933-34		1934-35
Czecho-Slovakia Exports (Sept./Aug.)	..	570,815	..	570,815	..	570,815	..	570,815	..	570,815
Germany " "	..	500,000	..	350,000	..	300,000	..	300,000	..	300,000
Poland " "	..	308,810	..	308,810	..	308,810	..	308,810	..	308,810
Hungary " "	..	84,100	..	84,100	..	84,100	..	84,100	..	84,100
Belgium " "	..	30,275	..	30,275	..	30,275	..	30,275	..	30,275
Total Exports	..	7,026,000	..	7,349,000	..	7,449,000	..	7,549,000	..	7,649,000
Of which Cubas to U.S.	..	2,577,000	..	2,800,000	..	2,800,000	..	2,800,000	..	2,800,000
All remaining Sugars to "free" markets		4,449,000	..	4,549,000	..	4,649,000	..	4,749,000	..	4,849,000
5% obligatory increase in Exports (2 cents f.o.b. Cuba) brings total for "free" markets to		4,671,450	..	4,776,450	..	4,881,450	..	4,986,450	..	5,091,450
$2\frac{1}{2}$% increase in Exports ($2\frac{1}{4}$ cents f.o.b. Cuba) brings total for "free" markets to		4,782,675	..	4,890,175	..	4,997,675	..	5,105,175	..	5,212,675
$2\frac{1}{2}$% increase in Exports ($2\frac{1}{2}$ cents f.o.b. Cuba) brings total for "free" markets to (or 5% obligatory increase if $2\frac{1}{4}$% not released at $2\frac{1}{4}$ cents).		4,893,900	..	5,003,900	..	5,113,900	..	5,223,900	..	5,333,900

(Quantities in Metric Tons, except Cuba which is Long Tons.)

The European Beet Sugar Crop.

Some Statistical Data of Recent Production.

With the issue last month of the first estimates of F. O. LICHT on the coming European sugar beet crop, interest is being concentrated on the fact that a reduction in sowings is a certainty (apart from the unknown factor of Russia), and speculation is already busy on the extent to which the output of sugar will be reduced. Leaving out Russia, the first estimate for 1931-32 for Europe envisages an acreage of 1,623,000 hectares (LICHT's second one at April 30th alters it to 1,607,000 hectares) as compared with the latest figures of 1929-30, which are 1,904,066 hectares. Incidentally, one notes that the first estimate of last year (excluding Russia) envisaged 1,969,900 hectares, whereas the actual area, as at present known, was 65,804 hectares less.

The following figures, which are derived partly from LICHT and partly from circulars of LAMBORN & Co., of New York, give the detailed beet sowings of last year in Europe, and the yield of sugar per hectare, both last year and over several years past.

Country.	Beet Sowings (in Hectares) 1930-31	Yield of Sugar — Per Hectare. (in metric tons) 1930-31	Average latest 3 years	Average. latest 5 years
Germany	460,107	5·433	4·759	4·571
Czecho-slovakia	236,203	4·847	4·475	4·365
Austria	33,037	4·540	4·157	4·282
Hungary	66,801	3·517	3·419	3·218
France	245,280	4·912	4·140	3·877
Belgium	55,567	5·074	4·757	4·375
Holland	57,462	5,220	4·979	4·686
Denmark	31,900	5·266	4·627	4·499
Sweden	35,624	5·249	4·480	4·360
Poland	196,300	3·948	3·690	3·410
Italy	111,385	3·698	3·588	3·545
Spain	91,000	3·406	3·229	3·177
Dantzig	11,000	3·636	3·820	4·298
Jugoslavia	51,500	1·941	2·068	1·864
Roumania	44,000	3·181	2·679	2·354
Bulgaria	22,000	2·636	2·127	2·164
Switzerland	1,500	4·666	4·180	4·202
England, Scotland, Wales	139,240	3·447	3·387	3·177
Irish Free State	5,360	4·850	4·285	3·773
Finland	1,300	3·076	2·064	2·071
Latvia	2,500	2·800	1·989	1·994
Turkey	5,000	2·000	1·603	2·448
Other European Countries	—	—	—	—
Europe—without Russia	1,904,066	4·485	4·066	3·866
Russia	1,044,000	1·724	1·605	1·795
Europe—including Russia	2,948,066	3·507	3·286	3·248

LAMBORN & Co. point out that should last year's record yield of 4·485 tons of sugar to the hectare be again obtained this year by the European beet sugar countries (exclusive of Russia) the crop would total 7,279,000 tons as against 8,541,000 tons last year, a reduction of 1,262,000 tons. The Russian crop, with last year's yield of 1·724 tons, would approximate 2,383,000 tons, an increase of 583,000 tons as compared with last year. The total European crop would therefore amount to 9,662,000 tons, a decrease of 679,000 tons from last year's record crop obtained under the most favourable weather conditions. Based on the average yield for the past three years (4·066 tons to the hectare)

the European crop, without Russia, would total 6,599,000 tons. With Russia included, on the basis of the average yield of 1·605 tons for the past three years, the total European crop would amount to 8,817,000 tons, equivalent to a decrease of around 1,524,000 tons. It is also to be noted that the three-year average yield of 4·066 tons to the hectare for all of Europe, outside of Russia, is larger than ever obtained during a single campaign prior to last year.

Assuming a five-year average of 3·866 tons to the hectare, the European crop, without Russia, would approximate 6,275,000 tons, a decrease of **2,266,000** tons when compared with the 1930-31 crop. Including Russia, a crop of 8,756,000 tons would result, and the decrease would total 1,585,000 tons.

Recent Developments in Cuba and their Implications.

By EARL L. SYMES.

The Falkiner Cane Harvester.

One of the most promising developments in agricultural engineering research as applied to the sugar industry is the Cane Harvester. After more than ten years of study and experiments with harvesting machines it appears that Messrs. Falkiner and Charley, the ingenious Australians, have finally produced a machine[1] which will cut cane faster and cheaper than the old hand labour methods. Several of the new machines have been working in Camaguey Province during the 1931 crop with very encouraging results. Working in daylight this machine will displace 80 cane cutters. When fields are properly laid out with rows at the right width and obstructions such as stumps and stones removed the machine could work day and night and thus do twice the work of eighty men in a twenty-four hour period. The harvester has been designed to cope with heavy tonnages of green cane, cutting the cane very low and thus obtaining more of the rich portion of the stalk than is usually taken by the hand cutter. The cane is chopped into short sections about six inches long and a strong air blast removes the lighter trash, loading the heavier stalk portions into a cart which travels along with the harvester. It is possible that more of the top end of the stalk containing low purity juice is carried to the mill in this way but the inclusion of the high purity butt ends may compensate for that.

The final success of this harvester opens several new and beneficial aspects for the sugar industry in Cuba. The most important, probably, is the reduction of costs for cane harvesting and for subsequent field cultivation. The chopping of the trash into short lengths will make it possible to run a light plough between each two rows of ratoon cane instead of the usual cultivation of every other row after the trash had been raked into the untouched row. Heavier tonnages in ratoons should result from this complete cultivation for every cane row. The higher speed in harvesting will require motorization of the hauling system and when proper handling methods have been developed for the short lengths of cane, the transfer from cart to railway car will be faster. In fact fewer field carts will be needed since elevating conductors may be used to carry the cane up to overhead hoppers from which the cars may be loaded by gravity. Mill yard cane storage can also be simplified by using cross conductors similar to those in beet dumps. Fewer railroad cars would be needed. This economy in number of cars and carts for hauling would be necessary since

1 For Patent Specifications see *I.S.J.*, 1928, 337; and 1929, 571.

higher cost motorized units and mechanical loading equipment will be needed to obtain every possible advantage from the quicker methods now available. The faster the movement of cut cane from field to mill the greater the recovery of sugar will be.

ALCOHOL PRODUCTION FROM MOLASSES.

With the multiplication of internal combustion motors on the modern plantation, the mills must utilize a portion of their molasses for motor alcohol production. The motors must be designed to work on this fuel and be equipped with high compression cylinder heads so that the greatest advantage may be taken of the ideal characteristic which alcohol possesses of great compressibility without knocking from pre-ignition. Gasoline is defective in this respect and must have ethyl lead compounds added or other treatment to withstand high pressures. The production of an alcohol-electric locomotive is also needed in order to do away with other fuels for which alcohol may be substituted. In equipping a plantation one or two sizes of interchangeable alcohol motors should be adopted, so that delays for repairs would be limited to the exchange of motors. Other sugar producing countries are using alcohol motors and the Cuban producers must study the new developments which when adopted will serve to reduce costs. Control of this portion of the sugar price is directly in the hands of the sugar producer and he should not neglect any possible method for cost reduction. Efforts to secure his profit from attempted world market price control are blinding him to the opportunities for profits in cost reduction by the adoption of new and faster methods in field and factory.

MECHANICAL ADJUNCTS TO CANE HARVESTING.

The successful operation of the cane harvester opens new fields of action for the machinery manufacturers. They must design the universal high pressure alcohol motor for sugar plantation use. The present harvester requires two motors and many more will be needed for the tractors and locomotives. Cane cut in short pieces will make the use of mechanical conveying equipment desirable in field loading stations and mill yard storage dumps. More alcohol distilling equipment will be needed, especially the new types which produce water-free alcohol for blending with other fuels. The mechanical revolution in wheat and corn harvesting has now been extended to cane harvesting, but it is accompanied by many interesting possibilities not applicable to wheat or corn.

A very important feature of the adoption of mechanical cane harvesting in Cuba will be the reduction in field hands required. All Haitians and other West Indian labourers may be returned to their home islands for the native Cuban population will be able to take care of the operations not mechanized. The critical economic conditions prevalent since the end of the 1931 restricted crop require that all unnecessary foreign labourers be repatriated at once. It is reported that 30,000 Haitians are now in Eastern Cuba without work. Very few mills that have closed keep more than four or five employees on the payroll, and the country people have a long dead season ahead of them. Many plantations are providing land and equipment for working it, so that the unemployed may produce food crops. The men who have come to work in the cane fields since 1914 have always depended on the grocery stores for their food. It is rather difficult for them to turn now to the land for their food crops. This is a step in the direction of diversification that was mentioned in a previous report.[1]

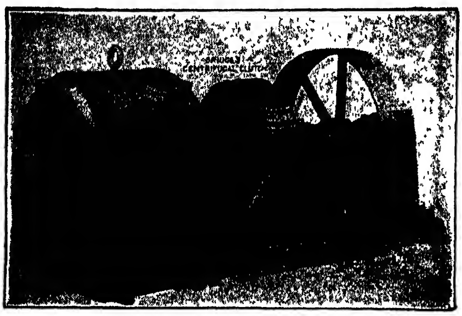
[1] *I.S.J.*, 1929, 419.

Heywood & Bridge's

FRICTION CLUTCHES AND MODERN MILLGEARING

IMPROVED PATENTS

Designed for their Job!



Bridge's Automatic Centrifugal Friction Clutch for Automatically starting Shafting, Machinery etc., Particularly adapted to High-Speed Shafting and Machinery driven through Electric Motors.

Mill managers and others to whom power economies are vital matters have often expressed surprise at the variety of drives we have been able to suggest for their special needs.

The economy made possible in such cases is by no means limited to effective power transmission. By eliminating shock and jar and promoting a smooth, even drive under all conditions the life of belts and gearing is substantially lengthened.

The ease and quickness with which the Heywood and Bridge Clutch can be put out of gear has prevented many serious accidents.

DUPLEX DRIVE. Enclosed double helical Cut Drive from 200 h.p. Diesel Oil Engine with two clutches for connecting and disconnecting two separate batteries of machinery, consisting of nine machines on either side. These clutches are fitted up with our "Acme" Release Gear connected with a wire rope passing along each battery of machines. In the event of accidents the whole battery can be disconnected instantaneously from any machine without stopping the engine.

We make a speciality of Machine-Moulded Gearing for accuracy and quick running. 13 Wheel-moulding Machines. Over 8000 Wheel Blocks. An engineer representative will wait on you with suggestions, if desired.

Write for our Illustrated Catalogue. Sent Post Free on request.

DAVID BRIDGE & CO. LTD.

CASTLETON FOUNDRY & ENGINEERING WORKS.

CASTLETON MANCHESTER

LONDON OFFICE:- 35, QUEEN VICTORIA ST E.C.

Bagasse Utilization by Dry Distillation.

By FRED. W. FREISE.

Several attempts have been made in Brazil to convert dry bagasse into valuable products by distillation and patents have been granted on processes leading to this end. But only one plant has passed the laboratory stage. Its use, however, was discontinued for reasons not inherent in the raw material or the process. Whilst the dry distillation of such vegetable matter as wooden stumps, trunks, boards and the like has been studied down to the last chemical and thermal details, and in certain countries has been developed commercially on a very large scale, the working up of fibrous material as bagasse, straw, shavings, or powdered matter as bark, saw-dust, etc., has always given considerable trouble technically and commercially.

Difficulties arise from the impossibility of adequate gas and vapour circulation through the heated material, interfering thus with proper heat transmission. Heat is almost entirely transmitted by convection and radiation from the heating surfaces so that large retort diameters are not possible. A non-conducting zone is formed near the centre ; and above all the distillation products stagnate and are decomposed to the detriment of the qualities of the final product. Proposals to overcome such difficulties are rotating distillation vessels, retorts furnished with internal agitators, the briquetting of the raw material, or again exposing shallow layers of material to the hot gases.

Rotating retorts generally work only intermittently, needing extra labour for charging and discharging, besides which they are rather clumsy and require frequent repair. Agitators cannot be lubricated properly at high temperatures, the inconveniences arising from over-heating and increased friction being very heavy. With briquettes the problem of strength arises, as if too solidly agglomerated much heat is necessary to penetrate them, whereas when soft, they simply disintegrate in the retort before they can be decomposed.

For these reasons the proper construction of a distilling device for such fuel as is now under consideration seems to be that which offers the shallowest layer possible to the hot gases evolved. This may be achieved by a furnace construction similar to those with travelling grates in which the bagasse is carried on a series of linked longitudinal bars which slowly pass through a gas generator, where the material is gradually submitted to destructive distillation. Or it may be charged into a vertical oven where inside a refractory brick lining a series of superposed conical plates is arranged, which, having convenient interstices between each other, allow the distillation material to sink down between the cone outside and the brick wall inside, thus allowing the distillate to escape through the central channel of the conical tower. The heat for the distillation is conveniently admitted through channels in the interior part of the brick lining. Most of the heat required can be obtained from the gases derived from a former distillation, the balance being provided by separate gas generators or other sources. The diameter of this shape of oven depends exclusively upon the nature of the material to be distilled, short stuff permitting a smaller diameter than longer.

Regarding technical data on this question, what follows may be of interest : Composition of raw material : 67 per cent. of fibre, 33 per cent. of moisture ; maximum dimensions, 12 in. × 2 in. × 0·5 in. ; smallest fibre bundles : 3 in. × 0·5 in. × 0·25 in. Thermal conductivity with an experimental range of temperature of 50-180°C., 0·0185.

Yield of distillates in a laboratory scale test : coke 34·5 ; condensible gases 8·5 ; non-condensible gases 31·6 ; and water 25·4. Yields from the

condensible gas fraction : acetic acid and homologous acids 10·55 per cent. ; methyl alcohol 0·62 ; oily substances 14·22 (spec. gr. 0·94-1·034) ; soft pitch 63·25 ; water as obtained 10·35 : gases and losses 1·01 ; a total of 100·00 per cent.

Compared with this theoretical yield, the actual results of even very carefully conducted runs widely differ. It may be mentioned that the exothermical phase of the distillation process which sets in at about 275°C. does so very violently, it being impossible to suggest any reason therefor. This period destroys valuable preformed distillation products to a great extent, increasing the percentage of gas, and rather strangely the non-combustible portion. Under normal conditions the retort gases show this composition : 61 per cent. of CO_2. 29 per cent. of CO, 2·75 per cent. of CH_4, 1·8 per cent. of H_2. The wetter the bagasse is, and the less tight the suction tubes, the poorer obviously the gas. The calorific value of such a gas is about 1200 calories. The coke discharged from the retorts or distillation ovens is very brittle suitable only as powdered fuel in the boiler-house. There is little chance of its withstanding the pressure of briquetting. It is certainly too soft for use in gas generators. Whether it might find use in filter columns is still doubtful.

It is not within our scope here to discuss the economical merits of this method of utilizing bagasse in preference to some other. But by way of comparison we may state that whereas one ton of bagasse produces as an average 2·3 tons of steam from and at 100°C., the pulverized coke produced by distillation evaporates between 7·0 and 7·2 tons of water from and at 100°C. It contains according to the author's tests, carbon, 85 per cent.; hydrogen, 3 per cent.; oxygen 11 and nitrogen and ash 1 per cent.; and one may expect 0·3 ton per ton of distilled bagasse. Taking into account the cost of producing the coke dust, there seems hardly a profit attached to it. To distil a ton of bagasse under present conditions (overhead and depreciation figured as normal) costs in Brazil the equivalent of 8d. working with a 100 tons a day plant costing £4500 erected and put to work. The cost of bagasse is taken here as being given free to the plant. If the raw material were entered at the same price as that paid by other boiler-house fuel, one ton would be put on the books as worth between 3·5 and 5·5 mil reis (1s. 6d.-2s. 4d.). The net profit arising from the acetic acid and by-products cannot be figured out here, market conditions in these commodities fluctuating too much.

In studying the question of utilizing bagasse for the evaluation of its distillation products, it is at the outset debatable whether a sugar factory should attach to its own manufacturing organization another chemical industry demanding far different equipment and supervision ; or whether such an industry might not much better be run by distillation specialists who are entirely segregated from the sugar industry. Which view be taken will undoubtedly influence the cost of the raw material and the ultimate revenue from the enterprise. However, there are positive indications that in one of the most prosperous sugar districts of this country the idea of utilizing bagasse in this way will soon be taken up. It is said that even the State Government will lend a helping hand towards its realization.

New Form of Prime Mover.—On Thursday, June 4th, a paper is to be read before the Royal Society of Arts, in London, by Mr. J. F. J. Malone, describing a new form of prime mover and its uses for locomotives, marine and other engines. The principles of this new type of engine, which derives its motive power from the expansion and contraction of fluids, will be fully demonstrated.

Use of Air Pre-Heaters in Sugar Mills.[1]

By Prof. E. C. VON PRITZELWITZ VAN DER HORST.

A very clear survey of the manner in which the heat available in the fuel is partly effectively employed in a boiler plant and partly wasted in various losses can be obtained with the aid of a diagram which shows the available heat per kg. of fuel as a current dividing into several branches.

In Fig. 1 "heat in fuel" means the high calorific value, that is the amount of heat obtained by burning 1 kg. of bagasse and by cooling down the combustion products to the initial temperature of, say, 30°, thus recondensing all the water-vapour in those gases and releasing the latent heat of evaporation in the process.

This amount of heat (B_h) is not fully generated in the furnace, because part of the fuel either does not burn at all or is carried off only partially burnt (unburnt particles in ash and slag, in flying ash and soot, or in CO). Part of the heat that is generated is lost by radiation and conduction of the furnace itself, and after deducting these there remains an amount of heat which determines the efficiency of the furnace in proportion to B_h. This efficiency cannot be determined empirically because the various losses cannot be separately measured.

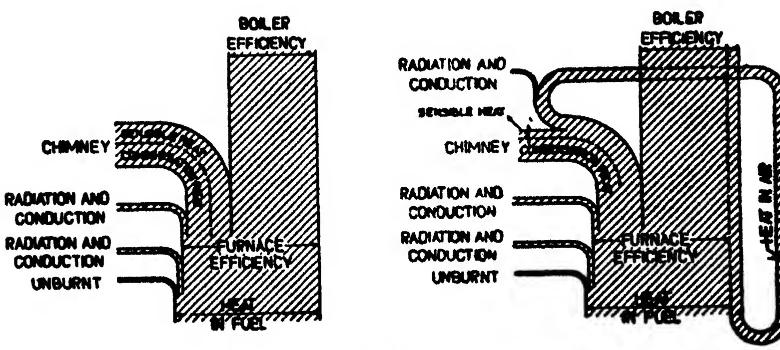


Fig 1.

Of the remaining heat only part is employed for the formation of steam in the boiler, part being lost by radiation and conduction of the boiler walls, and part in the chimney. Of this loss up the chimney, part is for the account of the latent heat of evaporation of the water-vapour in the flue gases, which cannot be retrieved because these gases cannot be cooled sufficiently. This fractional loss for bagasse with the customary moisture-content of about 44 per cent. is a fairly constant figure, amounting generally to about 16 per cent. of B_h.[2]

The rest of the chimney loss is the "sensible heat," which can be determined by multiplying the weight of the flue gases by their specific heat and the difference of temperature (compared with the surrounding air). Of the various losses this is generally one of the largest and, moreover, the most easily reduced. In our mills it ranges between 12 and 18 per cent. of B_h.

Thanks to the increasing importance attached to a good fuel economy, a large number of sugar mills in Java are now determining the temperature and

[1] Paper read before the Third Congress of the International Society of Sugar Cane Technologists. Java.

[2] Because it is not practicable with our present boiler plants to retrieve this latent heat, the corresponding number of calories is often deducted in advance from the high calorific value B_h and thus the *low* calorific value B_l is obtained. In the absence of any uniformity herein it is very necessary in boiler tests and efficiency figures always to state which of the two values is being used in the calculation.

carbonic acid content of the flue gases on leaving the boiler, the latter with the aid of automatic CO_2 recorders. With these two data the loss of sensible heat can be very simply calculated by means of the approximation formula of SIEGERT :—

$$h = c\,\frac{t_1 - t_2}{k}$$

in which h = chimney loss (sensible heat) in per cent. of B_2; t_1 = temperature of gases after boiler ; t_2 = temperature of surrounding air ; k = carbonic acid content of gases ; and c = a constant.

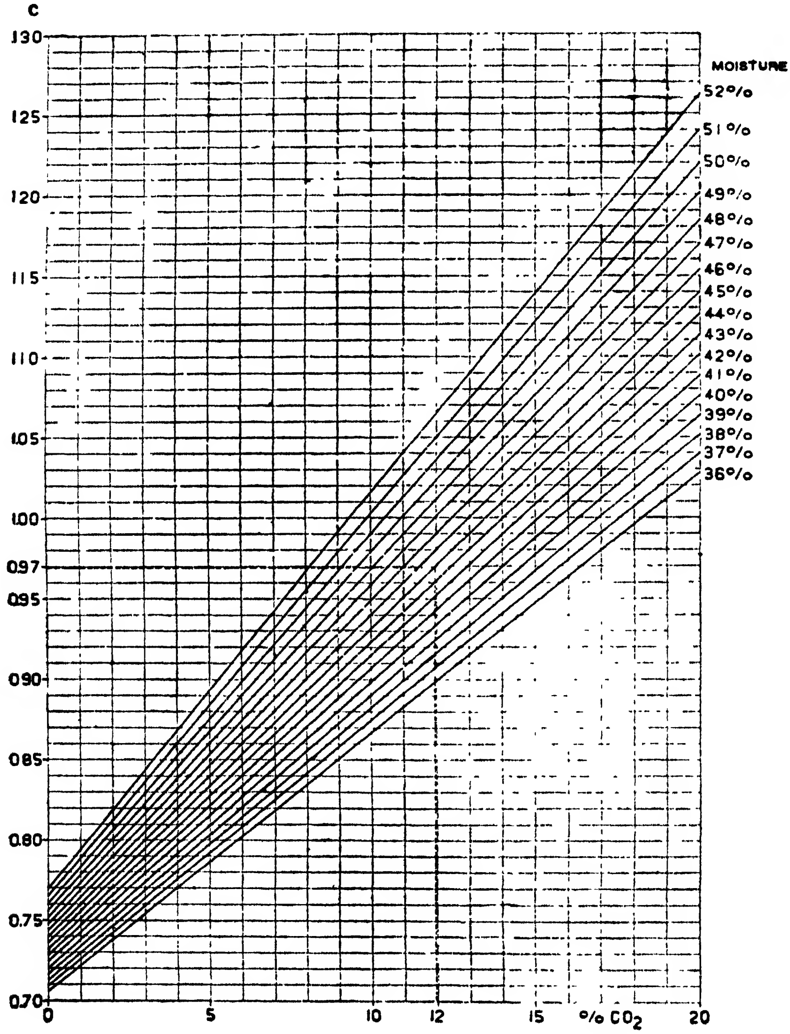


Fig. 2

The formula is based on the fact that the carbonic acid content is in inverse proportion to the amount of the gases (the greater the excess of air, the lower the carbonic acid content) and that at the temperatures we are concerned

with here the specific heat of the flue gases has a fairly constant value. According to SIEGERT, therefore, each fuel would have its own constant c, coal being about 0·65, for example (any deviation would not be more than a small percentage difference).

For flue gases from bagasse we cannot assume a fixed value for c owing to the high percentage of water-vapour, for c varies according to the excess of air and the moisture content. To facilitate a quicker calculation we have drawn a graph to show that variation (Fig. 2). Having thus determined the chimney loss in respect of B_1, we can calculate the total chimney loss (including now the evaporation heat of the water-vapour) in relation to B_h' from the graph in Fig. 3, where Vh = chimney-loss in relation to B_h; and V_1 = chimney-loss in relation to B_1.

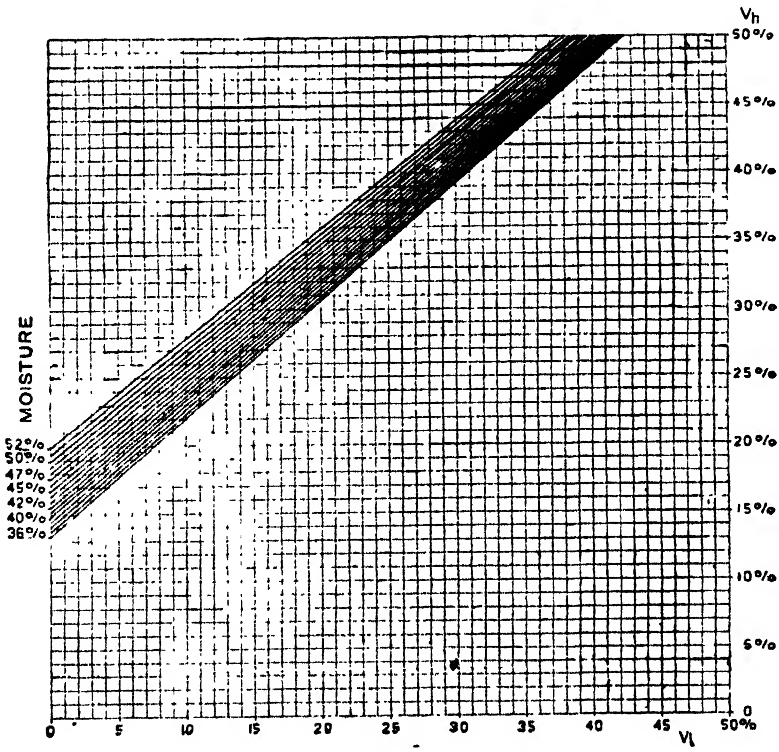


Fig. 3

We see from Fig. 2 that with a normal moisture-content (44 per cent.) and a normal carbonic acid content (about 12 per cent.) the value of the "constant" c is about 0·97, which is about 50 per cent. more than for coal. The flue gas temperatures being equal, therefore, the sensible chimney loss with bagasse is 1½ times what it is for coal, from which it follows that the saving obtainable by a given cooling of the flue gases would be likewise 1½ times as much.

There is thus every reason why the question of reducing this loss should receive particular attention in our sugar-mills, and there come in for notice in the first place economizers and air pre-heaters. Both devices recover

from the escaping flue-gases heat which would otherwise be lost. The economizer uses it to heat the feed-water, while the pre-heater heats the air needed for the combustion.

Going on average figures according to present practice, we obtain the following comparison : the available feed-water, coming from the first cells of the evaporator, has already a temperature of at least 95°C. With a steam pressure of 8 kg./cm.[2] (the temperature of the boiler-water therefore being 174°C.), the feed-water in the economizer ought not to be heated beyond 134°C., in order to avoid the danger of boiling in the economizer when feeding is reduced or suspended. That means a saving of about 7 per cent. from the amount of heat required for 1 kg. of steam, and the same saving can therefore be obtained in fuel consumption.

The air for the furnaces can safely be pre-heated to give a temperature as high as 180°C. on entry into the furnace ; in preliminary trials in one of the Java mills we even went up to about 280°C. for several days, without any particular trouble resulting, although in the long run such a high temperature may perhaps be objectionable from the point of view of upkeep of the grating

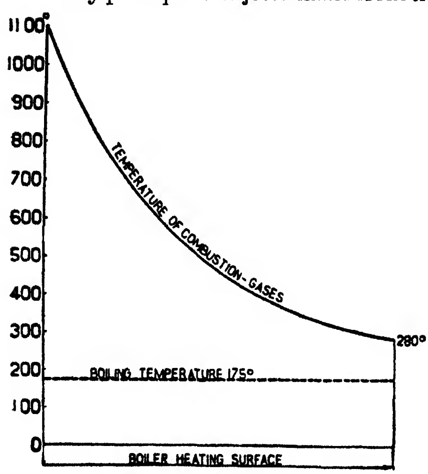


Fig. 4.

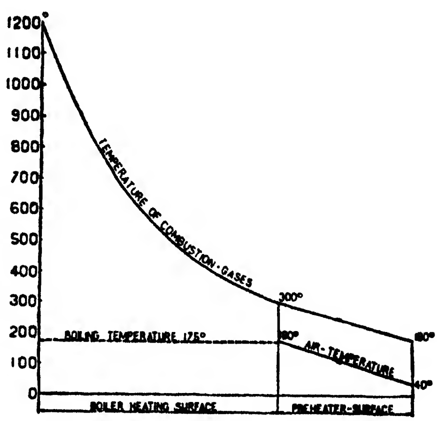


Fig. 5.

and the refractory lining. Against an increase of about 140°C. (initial temperature about 40°C.) in the temperature of the air, there is a decline of only about 120°C. in the temperature of the flue-gases, because with their high moisture content the latter have a higher specific heat. According to SIEGERT's formula above, the corresponding decrease in the chimney losses averages about 8 per cent. in relation to B_1. As the boiler efficiency obtained with bagasse fuel without preheated air seldom exceeds 60 per cent., the preheating gives a saving in fuel of 13 per cent. here. That assumes that the heat introduced with the pre-heated air is fully available to the boiler. It is true that in consequence of the higher temperature level at which the boiler is working there is some increase in the loss of heat by radiation and conduction outward, but, on the other hand, we must take into account that, due to the preheated air, a somewhat smaller excess of air will suffice for perfect combustion.

Of course, the loss of heat in the pre-heaters themselves and in the air-ducts must not be lost sight of. That is to say, in order to obtain a temperature of 180°C. at the entry of the furnace, the original temperature in the pre-

heater must be at least 200-220°C. according to the length of the flues. Accordingly the flue gases must actually be cooled still further than we assumed just now for the SIEGERT formula. Allowance must therefore be made for that, in calculating the dimensions of the pre-heaters and the installation for mechanical draught.

Before I come to that, however, I should like to refer to the saving in boiler surface obtainable by using pre-heaters. Figures 4 and 5 show the curves of the temperature of the flue-gases for a boiler without, and with, pre-heating. Besides the temperature of the flue-gases there is shown also the temperature of the heat-absorbing matter, that is, in the first case, only the boiler-water at boiling-point everywhere, and in the second case in addition to that the heat-absorbing air moving in an opposite current to that of the flue-gases.

The activity of every part of the heating surface is determined by the temperature-difference and by the heat-transmission coefficient, which shows how many calories per sq. metre per hour and per degree C. of temperature-difference is absorbed by the portion of surface concerned. As time does not permit me to go into details, suffice it to state 22 as the average figure for that heat-transmission coefficient of the actual boiler surface in the types of boiler most commonly in use in Java, and 15 for the pre-heater surface. The former depends above all on the velocity of the flue gases (which is, of course, limited in the case of natural draught) and the latter, besides, on the velocity of the air. Thus, while the boiler has somewhat the advantage in respect of the heat-transmission coefficient, the air pre-heater is at a far greater advantage in respect of the available temperature difference. The latter is the more pronounced when the flue gases are still further cooled in order to increase the efficiency ratio, a limit being quickly reached which would make further cooling through the boiler surface unremunerative.

That limit will lie at 250-300°C. according to the steam-pressure and other circumstances. With an air-preheater it will generally be more economical to carry the cooling by the boiler itself less far, that is to say to 300-350°C., and to effect the further recovery of heat from the flue gases by means of the cheaper air-preheater surface. That might be expressed in this way : the least active part of the boiler surface will be replaced by a more active and, moreover, cheaper air-preheater surface. To put that idea consistently into practice, however, would only be possible with new plants by accordingly choosing the proportion between the various parts of the boiler surface, both mutually and in relation to the grate surface.

With our present boilers we can go a little way in that direction by enlarging grate and hearth in proportion to the boiler, but it would not be possible to provide to the same extent as with new plants that the higher average boiler-load is obtained principally by increased activity of those parts of the boiler having the *lowest* load. We should be compelled to put up with a higher load also on the highest loaded (directly heated) surfaces, so that we could not go far in that direction with a view to safety and the durability of the boiler.

Air-heating is inseparable from mechanical draught ; the cooling of the flue gases reduces the natural chimney draught, while at the same time resistance is increased, because both flue gases and combustion air have to pass the pre-heater, flues and air-ducts.

In general, therefore, fans are necessary both for the supply of air and for the exhaust of the flue gases. As the power consumption for these fans plays a subordinate rôle, they will be employed at the same time to attain a

much greater velocity of gases and air in the preheater (10-20 m/sec.) than would be possible with natural draught (3-5 m/sec.). As I have remarked already, the heat-transmission coefficient is considerably improved by this increase of velocity of the gases, and the preheater surface can thus be proportionately reduced, which means a reduction of the purchasing costs, despite the more powerful fans and motors.

A graph given in GUMZ' book[1] is based on laboratory tests ; in a few cases in which we have had an opportunity to compare results obtained with tubular

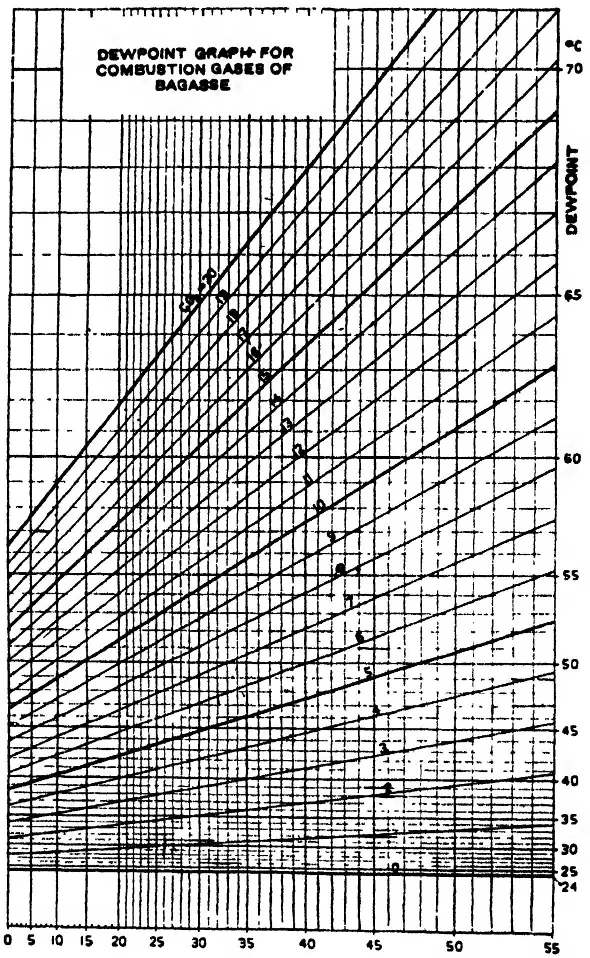


Fig. 6 MOIST

heaters in Java with this graph, they corresponded very well with it. These curves show clearly the great influence the velocity of air and gases have upon the heat transmission.

It will often suffice to have one flue gas fan and one air fan for several (or all) boilers, or one might give each boiler its own set of fans. The latter

[1] W. GUMZ : "Die Luftvorwärmung im Dampfkesselbetrieb." P. 151. (Otto Spamer), Leipzig. 1927.

PART VIEW OF A BATTERY OF BELT-DRIVEN CENTRIFUGALS
FOR A LARGE ENGLISH BEET SUGAR FACTORY.

"WESTON"

CENTRIFUGALS

OF ALL TYPES,

Belt, Water and Electric Driven.

First-class Workmanship.
Substantial Design.
Best Materials.

These qualities are embodied in OUR MACHINES, and backed by SOUND REPUTATION and COMPETITIVE PRICES, we confidently solicit your enquiries.

Our Electric-driven Machines have ample Motor power, interlocked Brake and Switch, and with our latest design of suspension, a perfect machine is the result.

All the most up-to-date Factories and Refineries have batteries of our machines at work.

No plant too small or too large for us.

POTT, CASSELS & WILLIAMSON,

MOTHERWELL — SCOTLAND.


The
Maxwell-Boulogne
PATENT
Simplified
JUICE SCALE
NOW THE CHEAPEST
STILL THE MOST
ACCURATE
AUTOMATIC SCALE
Extract from certificate received from Java Proefstation Pasoeroean
"—It is the most accurate weighing machine which exists, it is perfectly mechanical and automatic and needs no supervision. Its construction is so strong that it will, for years, need no repair."
The Director of the Java Experiment Station
(Signed)
Dr. Ph. van Harreveld
59 WORKING IN JAVA
Weighing Raw Juice, Imbibition Water, Syrup, Molasses, and Diluted Filter Mud.
MAXWELL-BOULOGNE PATENT JUICE SCALE.
GEORGE FLETCHER & CO., LTD.
DERBY ENGLAND

is generally to be preferred with new plants and very large units, but with the smaller boilers of our sugar mills (250-300 sq. metres heating surface) the former system is the proper one.

As to the different forms of air heaters I must be very brief. There are three prinicpal forms, viz. (1) those using tubes for the heating surface, in imitation of the system of "Howden's forced draught," long well-known for marine boilers; preferably so constructed that the flue gases flow *through* the pipes, which facilitates cleaning; (2) those having a large number of flat partitions between the successive flue gas and air compartments. This type, especially, has been produced in several different forms by various firms in recent years owing to its rapidly extending use in large electric power-stations; (3) those in which the whole of the active surface is very compactly housed in a moving (generally rotating) part, so that this surface is alternately brought into contact with the flue gases (absorbing their heat) and with the air (giving off heat). This type was invented by the well-known Swedish engineer LJUNGSTRÖM. A low number of revolutions of the rotor (not exceeding 10 per minute) is sufficient and the increase and decline of temperature of the preheater surface during a revolution is no more than 5-10°C.

So far there have been only a few installations of the tubular type in Java more or less improvised from old fire-tubes, while there is under construction an installation of the rotatory type (SCHWABACH'S system). Speaking generally, I expect chiefly applications of the preheaters of the 2nd and 3rd groups, which have the advantage of greater compendiousness and easier cleaning over the 1st group.

Finally, just a word about the probable durability of the air pre-heaters in connexion with the circumstance that sheet-iron is chiefly used for their construction).[1] Fortunately very favourable results have been obtained for many years with sheet-iron fans and chimneys of mechanical draught installations, working on flue gases from bagasse. These flue gases contain little or no sulphur and the iron is scarcely affected.

The question arises, however, whether with the much lower wall temperatures, such as occur at the air-inflow side of the pre-heaters, condensation phenomena will not arise, with the natural aggravation of the effect on the iron.

Since the chemical composition of the bagasse fibre is the same practically everywhere, the composition of the flue gases depends only on the moisture content of the bagasse and on the excess of air. It is therefore possible to draw a graph that would be generally applicable (Fig. 6), showing the relation between the dew-point (temperature at which condensation of the water-vapour in the smoke-gases begins) the moisture content of the bagasse and the excess of air. As can be seen from this graph the dew-point for normal values of moisture content and excess of air is in the neighbourhood of 60°C. The wall temperature of a pre-heater generally amounts to a little more than half the sum of the local temperature of the air and that of the flue gases. Thus on the air-inflow side with an air temperature of 30° and a flue gas end-temperature of 150° it would be a little more than 90°. There is therefore, still, a margin of safety before, for instance, owing to a blind corner on the smoke-gas side, the wall temperature declines to the dew-point, and from that standpoint there is no reason to fear an excessive effect upon the iron.

[1] The firm of E. Green & Son, Ltd., well-known for its cast-iron economisers, is constructing preheaters of cast-iron too.

An Improved Method of Cooling and Curing of Massecuite and Exhausting of Molasses.

By R. C. PITCAIRN.

Graphs and notes were compiled during the past milling period at the Hawaiian-Philippine Company's plant, Philippines, being the result of a further study of the Double Helix Crystallizer, referred to in a previous article.[1] From one of these graphs it was noticed that the four strikes treated in the same Double-Helix crystallizer averaged a gravity purity waste molasses of 31·92° and apparent purity of 27·07 at an average of approximately 30 hours per strike for crystallization purposes.

Three composite groups of strikes were treated in three crystallizers. One of these groups was treated in the Single Submerged Helix type of crystallizer ; the other two being from the Double Helix apparatus. It was noticed that the average of the four strikes in the crystallizer with the Single Submerged Helix was 103·56 hours, and the temperature of the massecuite in the crystallizer on discharging the same to the centrifugals was 101·8°F., resulting in a waste molasses of 32·4° gravity purity and 27·2° apparent purity.

On the other hand, the average of 18 strikes with the Double Helix crystallizer was 38·74 hours and the temperature of the massecuite in the crystallizer on discharging the same to the centrifugals was 102·6°F., resulting in a waste molasses of 32·7 gravity purity and 27·8 apparent purity.

Again, the average of 15 strikes in another crystallizer of the Double Helix type was 44·79 hours, and the temperature of the massecuite in the crystallizer on discharging the same to the centrifugals was 106·4°F., resulting in a waste molasses of 33·2 gravity purity and 28·1 apparent purity.

One Double Helix crystallizer containing 1400 cub. ft. capacity was able to handle satisfactorily the low grade massecuites from 400 tons of cane daily. In other words, 1 ton of cane required 3·5 cub. ft. of crystallizer space, and still gave exceptionally low purity waste molasses, while the Single Submerged Helix type required approximately 10·5 cub. ft. crystallizer capacity per ton of cane handled daily.

As the result of the previously reported work, and that now summarized, we have come to the following conclusions :—

(1) Complete and efficient lengthwise, crosswise and vertical circulation of the massecuite in the crystallizer causes an even distribution of temperature and an even continuous growth of the sugar crystal, and minimizes the formation of secondary grain.

Everyone in the sugar industry knows that complete and efficient circulation of the massecuite, whether in the pan or the crystallizer, is an absolute essential for proper growth of the sugar crystal. One of the great advantages of this Double-Helix crystallizer is that the circulation of the massecuite in the crystallizer is lengthwise, crosswise and vertical, thus preventing the formation of " dead spots " in the crystallizer. The complete and efficient circulation in this crystallizer insures a rapid and even growth of the crystals in the massecuite.

(2) Partial evaporation of the water content of the massecuite while in motion during the crystallization process favourably influences the growth of the sugar crystal.

It is well known that the density of the massecuite has an appreciable effect upon the recovery of sucrose and that higher density massecuites will give a molasses of lower gravity purity than massecuites of lower density, massecuite purities being the same. The Double-Helix crystallizer exposes

1 *I.S.J.*, 1930, 541. See also U.S. Patent, 1,769,799; *I.S.J.*, 1931, 90.

the massecuite in thin sheets to the atmosphere while the massecuite is still hot. A rapid partial evaporation of the water content of the massecuite thereby occurs, while the massecuite is cooling, with the result that massecuites from the Double-Helix crystallizer have a higher density than when discharged from the pans. To a modified extent, the evaporation that occurs in the pans is continued in the crystallizer.

(3) Even and rapid exposure of the massecuite to the air results in the rapid cooling of the massecuite.

This Double-Helix crystallizer differs from other types of crystallizers in general use in that the massecuite is raised into the air by the periphery of the upper helix. The massecuite drops from the helix back into the crystallizer in thin sheets, stretching while dropping, which causes rapid cooling.

(4) Higher temperature of the massecuite at which exhausted molasses is obtained improves the drying quality of the massecuite in the centrifugals.

The Double-Helix crystallizer, because of better circulation, affords a rapid exhaustion of the molasses in the massecuite while the massecuite is at a relatively high temperature. The drying quality of the massecuite in the centrifugals is improved as the viscosity of the molasses is lower because of the higher temperature. The capacity of existing centrifugal installations is increased without additional expense. The Double-Helix crystallizer has a decided advantage over the existing water-tube cooled crystallizers in which it is often customary practice to reheat the massecuite after it has once been cooled.

(5) When desired, water or molasses can be mixed thoroughly with the massecuite in the Double-Helix crystallizer within a very short time.

If desired, water or molasses can be mixed thoroughly with the massecuite in a much shorter time than with the older types of crystallizers. The possibility of thin solutions floating on top of the massecuite, previous to centrifugalization, is avoided.

(6) The time cycle and the amount of massecuite in process are reduced materially.

Actual trials with the Double-Helix crystallizer have demonstrated that, varying according to the initial juice purity, 3 to 4 cub. ft. of low-grade crystallizer capacity per metric ton of cane per day are sufficient to obtain the same results in exhausted molasses that can be obtained in the older types of crystallizers where 10 to 16 cub. ft. per metric ton of cane per day is the accepted standard. It naturally follows that the time cycle and the amount of massecuite in process are reduced materially.

(7) Economy of space and equipment secured.

Because there is less massecuite in process, the space required for crystallizers in a modern sugar factory can be reduced, as well as the amount of equipment required. Existing crystallizers can be changed, readily and economically, to Double-Helix crystallizers and their efficiency increased by 300 to 400 per cent. and still yield as good or better results as at present, both as to low gravity purity of final molasses and to rapid drying of the massecuite in the centrifugal, with an increase of only approximately 50 per cent. in power for driving the same crystallizer.

(8) This Double-Helix crystallizer can be handled by semi-skilled labour.

The Double-Helix crystallizer requires no more supervision than the present type crystallizers, and can be operated by the same class of labour as the present crystallizers.

The Australian Sugar Industry in 1929-30.[1]

In Australia sugar cane is grown only in Queensland and New South Wales, over 90 per cent. being in the former State. The following figures give details of the acreage, the cane grown, and the sugar produced during the last few seasons.

	Total Acreage Acres.	Sugar cane Production Tons.	Cane sugar Production Tons.
1922-3	216,886	2,315,982	306,265
1923-4	237,280	2,177,892	286,004
1924-5	273,512	3,400,319	435,818
1925-6	288,872	3,965,587	517,970
1926-7	284,828	3,155,916	415,876
1927-8	291,299	3,764,439	509,094
1928-9	299,357	3,883,725	537,574
1929-30	307,843	3,755,375	538,090

In 1929-30 the yield of cane per acre was 16·21 tons, as compared with 17·46 tons in 1928-29, while the yield of sugar to the acre was 2·27 tons, compared with 2·45 tons in 1928-29. A high sugar content is a feature of the Australian sugar industry, some districts in Queensland requiring only 6·4 tons of cane to the ton of sugar, and 6·91 was the average of 1929-30 for the whole State. In New South Wales the percentage is higher; but the following figures show the ratio for the whole of Australia over the past six years :—

SUGAR CANE REQUIRED FOR 1 TON OF CANE SUGAR.

	Tons		Tons
1924-5	7·8	1927-8	7·4
1925-6	7·7	1928-9	7·2
1926-7	7·6	1929-30	7·1

The cost of producing sugar in Australia is much above world parity prices and for this reason artificial aid has been given to the industry for some years, to enable it to hold the home market and to ship its surplus production. Owing to lower world prices, conditions latterly have been even worse than in previous years. The following table shows for the last few years (1) the price fixed by the Sugar Board for sugar delivered for home consumption, (2) the percentage of total crop exported, (3) the average price realised for the exported surplus and (4) the average price over all received by the industry :—

	Price for local consumption £ s. d.	Percentage of total crop exported Per cent.	Price for exported surplus £ s. d.	Average returns £ s. d.
1926-7	26 0 0	18·66	14 18 10	24 10 10
1927-8	26 0 0	31·18	12 2 6	22 0 4
1928-9	26 0 0	35·70	10 10 0	20 17 11
1929-30	26 0 0	37·00*	9 17 0	20 5 10

* Approximate.

The Sugar Board announced too, when declaring the return for the 1929-30 crop, that the fall in price for export would necessitate fixing a lower basic price for exportable sugar when acquiring the 1930 crop. The fall in world prices for sugar during the last few months will seriously add to the difficulties of the sugar industry. It is obvious that as the production of sugar expands, other things being as they are to-day, the return to the mills and the growers will fall. The home consumption being almost a constant quantity, increased production will require to be marketed at world prices, so that even if the embargo on imported sugar is maintained and the price for

[1] Abstracted from " Economic and Trade Conditions in Australia to December, 1930 " (Report of H.M. Trade Commissioner in Australia, as issued by the Dept. of Overseas Trade). H.M. Stationery Office. 1931. 3s. 6d. net.

local consumption fixed, the influence of export prices over a wider field will have embarrassing results. This fact has led to considerable discussion in the sugar industry regarding ways and means for limiting production. According to the *Australian Sugar Journal*, "it has been recognized for a number of years that, owing to the phenomenally low price of sugar in the markets of the world, combined with the steady growth of Australian production in excess of requirements, the sugar industry has been faced with a situation which could not be sustained, seeing that the net returns from the crop have fallen below the cost of production, notwithstanding the advantages derived from the embargo. In Queensland in the last three or four years various projects have been propounded for ameliorating the position. Some have gone so far as to suggest that sugar production should be limited to the amount of Australian requirements ; but this, it was quickly seen, would alienate support given to a continuance of the embargo, seeing that the principal ground of such support lay in the immense field for remunerative employment which the sugar industry has provided, and still is furnishing notwithstanding the drop in prices, which has not been followed by any diminution in wages. Any plan of restriction suggested was at once met with objections as to the basis of allocation, as between the various districts and mills, and even the individual growers. Everyone was fully convinced that the increase of production in greater ratio than the increase of the consuming population could not be permitted to go on uninterruptedly. But there remained not only the possibility of alienating sympathy by undue restriction, but also the problem of ensuring that even in the event of adverse seasons or destructive cyclones, floods, or droughts, such as the country has known—sometimes all three disasters in one year—the production, if unwisely limited, might fall lamentably short of Australian requirements, thus necessitating the importation of foreign sugar. For every ton by which sugar exportation might be reduced, it would be weakening the very strong claim to support based upon the advantage accruing to the Commonwealth from improvement of the balance of trade by the introduction of something like £2,000,000 a year by the sale of the surplus sugar in overseas markets."

In view of all these considerations it was suggested by the executive of the Australian Sugar Producers' Association that as a basis for action it should be agreed that in future no mill should be permitted to produce in any one year a greater quantity of sugar than the amount declared to have been produced in its year of greatest output, any excess to be regarded as sugar for export, and as such to be paid for at the export price, without participation in the sheltered price available for sugar sold for Australian consumption. By this means any excess sugar would be removed from the general pooling of the crop, and the loss on export sugar for those keeping within the limit would, as far as possible, be minimized. Eventually it appeared that agreement on such details could never be mutually arranged, and by general consent it was resolved to hand over the whole question to the Sugar Cane Prices Board. It has been deemed necessary, not only to put a limit on the amount of sugar to be produced by each mill, but also to restrict the area to be planted with cane by each registered grower throughout the sugar areas. At the time of writing it appears that owing to climatic variations, the output of sugar for 1930 will be substantially less than that of last year ; and the position also will be further improved to some small extent by the increase of population which has taken place.

As a result of handing over to the Sugar Cane Prices Board the responsibility for dealing with this matter, exhaustive proclamations were gazetted

laying down specifically the area assigned to each grower; plans have also been prepared showing the particular portion of each farm to be so planted. In addition proclamations have been issued fixing the amounts of the production of each mill, which will be regarded as their quota for home consumption, and therefore entitled to the fixed price of £26 per ton ; the remainder of their production is to be regarded as "excess," and therefore entitled only to a lower basic price regulated by world prices and fixed by proclamation of June 5th, 1930, at £7. 14s. per ton. (Afterwards reduced to £5. 12s. owing to a further heavy fall in world prices). By these means it is hoped to limit both cane areas and mill production in order to keep the position in hand.

Meanwhile there has again been active opposition to the sugar embargo scheme as a whole, which is said to cost the country some £7,000,000 per annum. The sugar agreement, which includes the embargo and the fixation of local prices, is due to expire at the end of July, 1931, but an application has been made to the Federal Government for its continuance on the old terms. As a result of this application and of the strong opposition which it evoked, the Government decided to appoint a Committee to investigate the whole position. This Committee, which consists of representatives of all interests, both producing and consuming, and employers and employees, has been taking evidence on the following terms of reference :—[1]

(1) Costs, wages, profits and prices in relation to the production, manufacture and distribution of sugar ;
(2) The financial condition of the growers of sugar in Australia ;
(3) The conditions of the workers employed in the sugar industry ;
(4) The terms of the existing agreement known as the Sugar Agreement, 1928-31 and any variation thereof considered to be desirable ;
(5) The efficiency of the industry in field and factory ;
(6) The values of land used for sugar-growing ;
(7) Economies which might be effected in relation to sugar production ;
(8) The effect of sugar prices on manufacturing industries, and on fruit-growing and fruit-processing ;
(9) Any possible reduction in sugar prices ;
(10) The necessity for the continuance of the present prohibition of the importation of sugar ;
(11) The relation of sugar prices abroad to the sugar industry in Australia ;
(12) Over-production of sugar and the sale of surplus sugar abroad ;
(13) The utilization of by-products of sugar cane ; and
(14) Alien penetration into the sugar industry.

Considerable attention has been given in recent years to the possibility of utilizing still further the by-products of the industry. Enormous quantities of molasses are still allowed to run to waste, and it is hoped to extend the use of molasses and of bagasse for other purposes. The most important venture up to the present, in this connection, is the production of power alcohol at Sarina. Considerable difficulties were met with in the first two or three years, but a product of alcohol and petrol has now been secured which is said to be satisfactory. Sales, which are in the care of an important petrol company, have rapidly extended, and it is reported were sufficient last year to keep the Sarina works fully occupied for five months ; plans have been drawn up for another works at Cairns, which will be erected when the present plant at Sarina is working to full capacity, and it is said that negotiations are being carried on for the purchase of much larger quantities of molasses from the sugar mills.

[1] According to the latest news to hand from Australia, the Report of this Committee has been presented, and has resulted in the Government adopting nearly all the recommendations contained in the Majority report and renewing the embargo for a further period of five years, while retaining the present price for a further three.—ED., *I.S.J.*

The following are details of results of some representative sugar mills :—

PROFITS OF SUGAR MILLS.

	Last Report.		Previous Report.		Remarks.
1...........	£62,657	..	£62,428	..	Dividend 8% + 1% bonus
2...........	£18,598	..	£16,632	..	
3...........	£39,142	..	£39,225	..	Dividend 8%
4...........	£14,146	..	£10,019	..	Losses in three preceding years.

Considerable interest was taken in the course of the year in proposals to develop sugar growing in Papua ; the formation was ultimately reported of a company which proposed to develop sugar growing on leases of 22,000 acres and with the expectation that 200,000 tons of cane would be in sight by 1933. Fears were expressed that any considerable development in Papua might ultimately prove a menace to the sugar industry of Queensland unless the embargo were extended to cover such production.

Sugar Cane Research in India.

Report of the Pusa Sugar Bureau for 1929-30.

The Report of the Secretary (Mr. WYNNE SAYER) of the Pusa Sugar Bureau for the year 1929-30 states that the cane propaganda work continues to progress satisfactorily and to prove of considerable utility. The steady increase in the area under improved cross-bred Coimbatore canes and the higher tonnage yields of these varieties as witnessed in the yearly increasing quantities of cane crushed in sugar factories and the steady rise in the recovery percentage of sugar in Indian factories all show the excellent work on the agricultural side which has already been accomplished ; and this augurs well for the future development of the industry.

Coimbatore Canes in Use.—Co 213 is the standard mill cane of India at present, over 12½ million maunds[1] of this cane being crushed yearly by the factories and no other cane as yet holds the balance so equally between the mill and growers in unirrigated tracts.

Co 223, which is reported to have done so well in the Punjab and which is of Co 210 type, was reintroduced for further trial against Co 210. To date, however, the latter has maintained its superiority under local conditions. Co 214 is now grown chiefly as the early ripening cane in the Darbhanga district of Bihar. Co 205 is now being replaced in North Bihar by Co 285, as the mills here have definitely declined to take bulk supplies of this cane.

Co 290 has continued to show promise and a mill trial was arranged in the month of December, 1929. The cane was found to mill easily and to possess a very low fibre content, a very excellent thing from the milling point of view, but this had the disadvantage of rendering the cane more attractive to wild animals and also probably making it less able to stand well in bad weather.

Co 213, 210 and Co 214 are now established in the Marhowrah area where previously some difficulty was experienced in growing them. In consequence, the distribution of the Coimbatore canes is now in progress in this tract and the extension of these cross-bred canes is going on throughout Saran.

In an endeavour to find a suitable cane for replacing Co 205, five new varieties were put under trial, two of which are showing considerable promise. Experimental plots of Co 290 have been planted at Dowlatpur and Gongowlie, and Co 285 is also being tested at the latter place. This system of trying out

[1] 1 maund = 82⅓ lbs.

new varieties showing promise in the preliminary trials on different estates is of great value, and a similar system is adopted in Java before putting out new seedling canes. Co 281 has now reached a stage where an outside test will be of distinct value.

Industrial.—The number of sugar factories in India increased by one during the year under report, an additional factory having been put up at Pilibhit. A new factory is also contemplated in Bihar and one already projected in the Punjab was under construction during the year as also a factory at Doiwala in the Dehra Dun District of the United Provinces.

The production of sugar direct from cane in 1928-29 amounted to 68,050 tons as against 67,808 tons in 1927-28 ; the total quantity of sugar refined from *gur* fell from 52,055 tons in the previous season to 31,038 tons in 1928-29. This decrease was principally due to the low price of white sugar rendering *gur* refining unprofitable. Thus the total production of sugar in India was 99,088 tons in 1928-29 as against 119,863 tons in the previous season.[1] It may be mentioned here that this decline in total production is due to the marked decrease in the quantity of sugar refined from *gur*. Reviewing the last five seasons' average percentage recovery of sugar direct from cane in the sugar factories, we find that there is a steady improvement particularly in the white sugar tract of the eastern portions of the United Provinces. The average percentage recovery of sugar direct from cane in the sugar factories shows a steady improvement during the past five years, particularly in the white sugar tract of the eastern portions of the United Provinces. This will be clear from the following figures :—

	Percentage Recovery				
	1924-25	1925-26	1926-27	1927-28	1928-29
All India	7·81	8·07	8·49	8·62	8·59

Commendable efforts are being made by the Indian Sugar Producers' Association to come to some working arrangement among West Gandak factories for the supplies of cane among themselves, so that unnecessary long haulages by rail may be avoided and ruinous competition among the factories may not arise. Several meetings were held during the year, and it is hoped that success will finally crown these efforts and the present impossible position be radically altered.

In this connexion Mr. SAYER remarks that the main obstacle to the rapid expansion and prosperity of the sugar factory industry in India is the difficulty of getting adequate supplies of good cane at reasonable prices within the area commanded by a single factory, and the impossibility in consequence of making the factory take a proper interest in the production of its raw material ; and it is on this agricultural problem that the joint efforts of the Agricultural Departments and of the management of factories will have to be concentrated in the future, as it is here that success or disaster will be met with.

During the year under report the Government of India enhanced their revenue duties on all imported sugar by Rs. 1-8 per cwt. for each grade of sugar. The revised duties are as under :—

23 Dutch Standard and above	Rs. 6-0-0 per cwt.
Below 23 Dutch Standard but not inferior to 8 Dutch Standard	Rs. 5-8-0 „ „
Below 8 Dutch Standard and sugar candy ..	25 per cent. *ad valorem plus* Rs. 1-8-0 per cwt.

It may be added that there is no excise duty on sugar locally manufactured.

1 For the 1929-30 figures see *I.S.J.*, 1931, 3. It is a defect of the Pusa Report that it does not give the figures of the year it purports to review.—Ed. *I.S.J.*

Abstracts of the International Society of Cane Sugar Technologists.

Under the scheme instituted by the I.S. of C.S.T. a collection of abstracts of papers a ongricultural and technical subjects is prepared monthly. A selection from these "Sugar Abstracts" has been made by us from the material issued, and appears below :—

Beet Sugar Manufacture.

Experiments with the Zueff-Vostokoff Continuous Pan-Boiling System. **V. I. Kolpakoff and B. A. Burdakoff.** *Zhur. Sakh. Prom.*, 1930, **4**, 458-466.

A continuously operating system of pan-boiling second sugars, constructed according to the ideas originally propounded by Prof. Zueff and later modified by Zueff and Vostokoff, was erected at the Deryugin factory. In this system an ordinary vacuum pan is connected with a horizontal jacketed tank through a wide conical connexion. A second massecuite is finished off as usual in the pan while the connexion between the pan and the conical passage is closed : the finished massecuite is then dropped into the jacketed tank, a new massecuite is grained in the pan, and the connecting passage is opened. The liquid in the pan is kept in a constant state of ebullition and the small sugar crystals are tossed about by the rising bubbles of vapour until they acquire such a size and mass that gravity pulls them with the concentrated mother-liquor down through the connecting passage into the tank, which has an outlet. When the system is in full operation, massecuite flows continuously out of the tank and fresh syrup flows into the pan at a compensating rate ; the level of liquid in the pan is thus kept at a constant height and the whole heating surface of the pan is kept submerged.

Although this apparatus has not shown any special advantage in relation to steam economy, it is considered to have the following points in its favour : (*a*) ease of operation, the operator having only to maintain a constant rate of boiling and a constant level of juice ; (*b*) more complete utilization of heating surface : (*c*) greater hourly capacity, since no time is lost in taking in syrup or dumping the pan ; and (*d*) reduced labour costs. But the principal difficulty encountered was the occurrence of a certain amount of false grain in the crystallizer, which slowed up the work at the centrifugals. This false grain is ascribed to irregular cooling, due to faults in the distribution of the cooling water in the jackets surrounding the crystallizer. It is expected that when the arrangement is modified so as to allow of uniform cooling in the interior of the crystallizing mass, the lack of homogeneity of the grain will be remedied.

Tests with the Hummelinck Colloid Filter. **C. W. Schonebaum and C. P. Zonnevylle.** *Tijdschrift alg. Tech. Ver. Beetwortelsuikerfabr.*, 1930-31, **26**, 159-169.

Two filters constructed according to the Hummelinck patent[1] were set up in a Dutch beet sugar factory for filtering the raw juice before liming. These filters resemble an ordinary bag filter except that the frames are covered with a rather loosely woven cloth and that very little pressure is applied. The idea is to afford merely a support for the colloidal particles of the raw juice, which act as the real filtering medium. The two filters as installed each contained 40 frames of 1 sq. m. filtering surface. It was found that they were capable of filtering an average of 95,000 litres (about 21,000 gallons) of raw juice per hour in an average cycle of 5 hours. It was, however, necessary to bring the unfiltered juice to an optimal *pH* (not stated), which was effected by

[1] *I.S.J.*, 1930, 389.

addition of about 0·025 per cent. of soda, the exact amount required being determined empirically at intervals; in general the most rapid filtration was obtained when the juice was still slightly acid. This addition of soda to the raw juice renders further additions for deliming purposes unnecessary; it is thought that lime could be used instead of soda for this preliminary neutralization.

Before entering the colloid filter the raw diffusion juice passed through a good de-pulper, which retained the coarser particles; the colloid filter then had only to remove the finer suuspended matter. The amount of solids retained on the cloths amounted to about 0·25 per cent. of the total non-sugar of the juice, corresponding to an increase of about 0·2 to 0·25 in the purity of the juice. During the month that the colloid filter was in operation the "purifying effect" of the clarification process was raised from 35 to 39 per cent., which is considered very satisfactory. There was also a 5 to 10 per cent. improvement in the colour of the juice, the red components completely disappearing, leaving the juice a pure yellow, or at most a yellow brown, particularly toward the end of the campaign. The effect of the colloid filter was further seen in the excellent behaviour of the juice in the evaporating and pan-boiling stations. The fine particles of pulp removed by the filter consist largely of pectinous matter, and ordinarily are hydrolyzed in defecation with lime, giving organic acids, which form the "residual lime" content of the juice responsible for scaling, and for extra additions of soda working deteriorated beets.

ZELEZNIAK CONTINUOUS CENTRIFUGAL. Editorial. *La Betterave.* 1931, 7.

The writer was present at a demonstration, conducted by Prof. SUCHORZLWSKI of the Warsaw Polytechnic School, of the performance of the Zelenziak continuous centrifugal. The apparatus consists essentially of two conical concentric baskets, surrounding a central sleeve through which the vertical shaft of the suspended machine passes. This sleeve reaches nearly to the bottom of the inner conical basket. In operation, the massecuite is fed by a chute to the sleeve surrounding the shaft, the subsequent course of the massecuite being shown by the arrows. After issuing from the bottom of the sleeve the magma travels up the sloping face of the first conical basket, which is perforated; the mother-liquor passes through the perforations and is drawn off by channels provided for the purpose. The crystals pass over the rim of the first basket and fall to the bottom of the second basket, travel up the sloping perforated face of this basket, and drop into a passage which conducts them to a receptacle under the machine. The machine is run at 280 r.p.m. on first sugars and 420 r.p.m. on thirds. With well-grained first massecuites the capacity is said to be 20 to 30 metric tons per hour, and 10 tons with second sugars. The power required is 7 h.p. The writer witnessed tests with the three kinds of massecuites. The results as to first sugars were not striking; but as regards the curing and affining of raw sugar the work of the machine is characterized as perfect.

EXPERIMENTS WITH THE HAUBOLD HORIZONTAL CENTRIFUGAL. **N. N. Kudelya and G. S. Boyandin.** *Zhur. Sakh. Prom.*, 1930, 4, 470-473.

The Haubold centrifugal (German made) differs from ordinary centrifugals in that it revolves on a horizontal instead of a vertical axis, its operation being as follows: The basket is first run at a low speed while the magma automatically flows in until a layer of predetermined thickness is formed. The speed is then automatically increased to expel the liquid. At the expira-

tion of a fixed period the charge is sprayed with water or steam, the speed is again automatically decreased, a self-acting scraper comes into action, and the charge in the centrifugal basket is scraped off and discharged by an inclined trough which projects outside the basket. This apparatus is said to have given good results in chemical industry with such products as nitro-cellulose and salts ; but up to the present there is no record of its having been introduced into the sugar industry. One of these machines was tried out by the authors at the Krasnozvezdin beet factory, in comparison with a Weston machine. The results appear to be unfavourable to the new system, at least in its present form. In order to obtain tolerable results it was necessary to dilute the massecuite to 84 or 85° Brix. In comparison with the Weston machine, the yield of sand sugar calculated on the weight of the massecuite was appreciably smaller. These unfavourable results appear to be due to the fact that the construction of the centrifugal lining of perforated metal (openings 4·5 mm. in diam.) is such that it becomes clogged with sugar which is not removed by the scraper, there being a clearance of 5 to 10 mm. between scraper and lining. Frequent stoppages for washing or steaming out the centrifugal are therefore necessary. These defects noted will need to be corrected before the machine will be suitable for sugar factory purposes.

USE OF THE CONDUCTOMETRIC METHOD FOR COMMERCIAL ASH DETERMINATION IN RAW SUGAR. **J. Pucherna.** *Zeit. Zuckerind. Czecho-slov.*, 1930-31, **55**, 205-206.

The author has employed the Sandera conductometer during two campaigns for determining ash in the beet sugars passed from the raw sugar department to the refinery of his concern, in each case comparing the results of this method with those of the gravimetric method. Out of a total of 607 analyses there was absolute agreement in 18 per cent. of the cases ; in 84 per cent. the deviation did not exceed $\pm$ 0·03 per cent. ; in 16 per cent. of the cases the deviation exceeded 0·03 per cent. only in 6 per cent. of the cases. The larger deviations were undoubtedly due to mechanical impurities, which tend to increase the apparent ash content by the gravimetric method.

EVALUATING ACTIVE CARBONS. **A. S. Sipyagin and E. S. Serkin.** *Zhur. Sakh. Prom.* 1930, **4**, 466-470.

For use in the raw-sugar house, a standard coloured solution is prepared by making a 5 per cent. solution of molasses or a 25 per cent. solution of yellow sugar ; for the refinery end a standard is made by diluting 50 grms. of table syrup. These standard solutions are to be treated with kieselguhr and filtered ; 0·5 grms. each of the standard carbon and the carbon being investigated are dried to constant weight and placed in two 250 cc. Erlenmeyer flasks provided with vertical glass tubes as reflux condensers ; 100 cc. of the standard solution is added to each flask, and they are then placed on a water bath along with a similar flask, containing 100 cc. of the standard solution but no carbon. The three flasks are allowed three minutes to attain the temperature of the bath (75-80°), after which they are further heated for 10 mins. with constant shaking and filtered hot ; on cooling, the colours are measured in a Stammer colorimeter, and the decolorization per cent. calculated.

BALED BAGASSE FUEL.—Bagasse compressed into 10 or 12 lb. bales has given good results in loco firing at the Mossman Mill, Queensland. This is following practice in other countries, where many factories are utilizing their surplus bagasse for fuel requirements on the estate.

Java Technical Notes.

Factors influencing the Exhaustibility of Molasses (Value of the "Ash per Cent. Non-Sugar" Value in judging the Exhaustion of a Molasses). J. G. Thieme. *Archief,* 1930, **38**, II, No. 51, 1155-1182.

Different investigators, as Prinsen Geerligs, have insisted on the significance of the "glucose/ash" quotient of a molasses as a criterion of its exhaustion. But according to Sijlmans[1] it is only the glucose that exerts any practical influence; the effect of the ash constituents may be ignored; and "glucose per cent. non-sugar" can be substituted for the glucose/ash quotient as an indication of the condition of the molasses. This theory was in vogue to an extent in 1929; but it ill explained the poor exhaustion of the molasses of that year from the Goenoengsari, Sembro, and Bedadoeng factories in Java. It seemed therefore apposite to again examine the question as to the substance or substances which control exhaustibility. The molasses were obtained from 9 defecation, 6 sulphitation, and 4 carbonatation factories, being brought (after analysis) to 8 different concentrations, mixed with crystal in excess, and maintained at constant temperature, viz. 29°C. in motion until after 10 to 14 days equilibrium as determined refractometrically was attained. Then the glucose, the sulphated ash, and the ash composition were determined. Lastly the exhaustion was judged from: (1) the sucrose per cent. at 81 per cent. dry substance; and (2) the purity at 28 per cent. water. Very numerous figures were tabulated, and the results discussed according to the van der Linden phase rule theory of the formation of molasses. Following are the author's nett conclusions:—

There is only a slight correlation between the "glucose per cent. non-sugar" and the exhaustion; and this connexion must be regarded as a very unreliable one. To the contrary, the "glucose/ash" quotient (to which Prinsen Geerligs and van der Linden have worked), frequently regarded in other countries as a useful criterion, is shewn to be a more valuable figure. But a still better one is found in the "ash per cent. non-sugar," which, in fact, is recommended as a very trustworthy figure for judging the exhaustion of a cane molasses. It is a positive correlation, its average error is smaller than in the case of the "glucose/ash" quotient, and the connexion is thus more reliable. The correlation between the "alkali per cent non-sugar" and the exhaustion is likewise a better one than is afforded by "glucose/ash" quotient, there being in fact a better agreement than in the case of the "ash per cent. non-sugar." It can therefore be stated that the exhaustion of molasses mainly depends (temperature and concentration being constant) on the relation of the inorganic to the organic non-sugars, the alkalis of the inorganic non-sugars exerting the greatest effect. In practice, as the determination of the alkalis is a tedious operation, one would of course use the "ash per cent. non-sugar" quotient. Other points that emerge from this research are:—That the addition of soda for the precipitation of soluble lime salts, as is sometimes done in Java in the carbonatation factories, is disadvantageous. That cultural conditions, as soil and climate, can in general exert a greater influence on the exhaustion of cane molasses than can clarification, a soil high in soluble salts and a dry climate resulting in a high molasses purity. And finally that the comparison of the exhaustion of molasses on the basis of their purity only is impracticable. Rather should one judge a molasses by means of its purity value in conjunction with its "ash per cent. non-sugar quotient."

---

[1] *Archief,* 1924, III, p. 413.

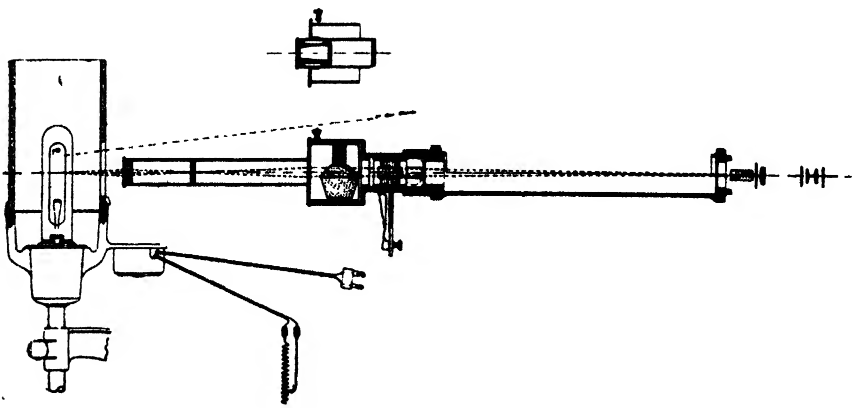
CARAMEL PREPARATION FROM MOLASSES. **D. J. Akkerman.** *Archief*, 1930, **38**, II, No. 29, 677-682.

In Java high-polarizing sugars are washed up in the centrifugals with a solution of caramel in order to convert them into a sufficiently dark "muscovado." Caramel used for this purpose must be low in polarization and in ash, and must have a sufficient colouring power. It can be prepared from sugar without difficulty; but naturally it would be more economical to use molasses as the raw material. A method of preparation using molasses has been worked out in the laboratory of the Proefstation, and has been applied on the technical scale in the Soemberredjo s.f. with satisfactory results. Before, however, describing it, the author gives the results of his preliminary experiments leading to the elaboration of the method, and a summary of his work is as follows: On heating dry sugar to 160-180°C., a considerable volatilization accompanied by caramelization occurs, the pol. and the *pH* falling, and the extinction, conductivity and reducing sugars increasing. During heating the sucrose is inverted, and the caramelized invert sugar has a dextro-rotation, continued heating never reducing this much below about 30°V. per 100° Brix. Treatment with strong acids (as in the double polarization method of analysis) lowers this pol. only slowly. Salts exert a considerable effect on the caramelization, some preventing and others accelerating it. K_2CO_3 and K_2SO_4 have a retarding effect; whereas KH_2PO_4, $FeSO_4$ and $FePO_4$ appear to favour it, though the reaction of the salt is of great influence. Quite different results were obtained with these salts above 140°C., compared with those got below that temperature, and it is evident that their effect is a matter requiring more precise investigation. Now the actual factory method of preparing caramel from molasses is described, though few details are given: Molasses diluted to 30°Bé. is allowed to subside, in which way about 15 per cent. of the total quantity of ash present in this liquid can be separated, at least in the case of the molasses resulting from defecation factories. SO_2 is passed in during 3 hours at 110°C. in order to invert the sucrose, this being done in the belief that inversion must precede caramelization. Excess of SO_2 is expelled by heating to 110°C. for half-an-hour, following which are added 1 to 4 litres of milk-of-lime at 15°Bé. per hectolitre (22 gallons) of the originally subsided molasses of 30°Bé., and the mixture heated for an hour and a half at 125°C., at the end of which time it is transformed into a caramelized syrup. Factories having a molasses with an ash content lower than 14 per 100°Brix can use this process of preparing caramel for the production of high polarizing raw sugar with less than 0·4 per cent. of ash.

A NEW POLARIMETER LAMP FOR SODIUM LIGHT. **H. C. Prinsen Geerligs.** *Archief*, 1931, **39**, I, No. 7, 160.

Anyone who has done polarizations using a sodium flame as the source of light well knows the great inconvenience that is connected with the sodium flame burner, for example, the spluttering about of the salt, or its falling in the molten state into the gas opening of the burner. Besides these manipulative difficulties, salt vapour is unpleasant, and furthermore the illuminating power of the flame is very low. It is therefore opportune that the Osram lamp makers have now invented an electric lamp which gives a pure sodium light 12 to 30 times intenser than that of an ordinary sodium salt burner. This lamp is being used for polarimeters with circular degree scales with or without filtration. By means of a condenser, the most luminous spot of the lamp

is transferred without appreciable alteration in size to a slit of fixed width in the polarizing apparatus. A lens then throws the picture of the slit on the surface of the analyser so that its whole surface is illuminated. In this way an illumination 12 times greater than with the ordinary sodium burner is obtained, one thus being able to polarize very dark liquids with great accuracy. Investigations are now being carried on by FRANZ SCHMIDT & HAENSCH, Berlin, in collaboration with Prof. SCHÖNROCK, of the Institute for Sugar Industry, Berlin, to construct saccharimeters by which with the aid of this "Na-Monochrom" lamp one can polarize very dark liquids with great accuracy, using a relatively small half-shadow angle. If these attempts succeed, then it may be possible to do away with the whole quartz-wedge compensation, which at present may give rise to errors in reading especially with temperature changes. Then the circular scale will so be altered that one will read Ventzke degrees directly.



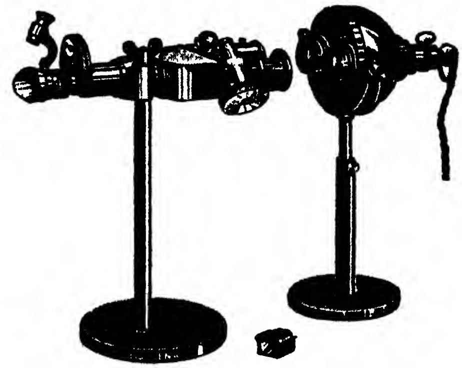
[SCHMIDT & HAENSCH have just communicated to us some particulars of their new lamp, which we add to DR. PRINSEN GEERLIGS' interesting remarks. They call it the "sodium small lamp" (*Natrium-kleinlampe*). Its spectrum exhibits the two very bright *D*-lines, and some other relatively dark lines. In order to obtain quite pure D_1 and D_2 light, a bichromate or glassfilter is used as heretofore for sodium lamps of different kinds. Or, better, the simple "Monochromator" apparatus is attached to the polarizing apparatus as shown in the drawing herewith. The new lamp can be used for the polarimeters 46 and 47 of the S. & H. catalogue Ia with the filter which is provided with those apparatus, this arrangement giving an illumination 20 times that of the ordinary sodium burner; but for polarimeters No. 48 to 63 the "Monochromator" or other filtering device must be used. The new lamp is equipped for A.C. or D.C. current at 110 or 220 volts, and takes 1·5 amps. It costs RM. 95 complete with its mounting.—ED., *I.S.J.*]

MECHANICAL STOKING OF BAGASSE AT GAYAM FACTORY. **J. Spoelstra.** *Mededeelingen*, 1930. Since the results previously reported,[1] several factories have tried the mechanical stoking of their bagasse furnaces ; but only Gayam has adopted the system entirely. Its power plant has five boilers ; it formerly employed 18 men and two foremen per shift for the stoking by hand ; but now only four men are used to stir up the fires and rake the grates. Altogether, there was a better utilization of the available heat in the bagasse, analyses of the flue gases, moreover, showing a figure of at least 15 per cent. for the CO_2.

1 *I.S.J.*, 1930, 92, 320.

The "Step-Photometer"; A New Apparatus for *pH* Determination in Coloured and Cloudy Liquids.[1] **H. C. Prinsen Geerligs.** *Archief*, 1930, **38**, II, No. 43, 993-994.

Hardly, writes Dr. Geerligs, has the determination of the hydrogen-ion concentration or *pH* value by means of electrometric apparatus, or by means of colour indicators with their buffers and colour charts, been put into practice when an entirely new device is offered for the purpose. This is the so-called "step-photometer" of the well-known firm of Carl Zeiss, with which the degree of acidity or alkalinity of a liquid can be read off very much in the same way as with a polarimeter, there being the further advantage that if need be it can be used for coloured and cloudy liquids. The method is based on the measurement of the degree of extinction of light which by previously passing through a filter has been deprived of the greater part of its rays on being transmitted through a liquid containing one or other of the nitrophenols.



One of the nitrophenol indicators which covers the range of *pH* to be determined is chosen, for example (according to Michaelis), 2·6-dinitrophenol for 1·7 to 4·4; or 2·5-dinitrophenol for 4·0 to 6·0; or para-nitrophenol for 5·0 to 7·0; or again meta-nitrophenol for 6·3 to 9·0 *pH*. These indicators do not change in colour with the alteration of the *pH*, only in intensity, proceeding from colourless at low *pH* to yellow at a high degree. Hence, with the alteration of the degree of acidity the colour of the reagent is stronger or weaker, the apparatus serving to register the degree of intensity of this colour, and consequently registering the *pH*.

The apparatus is so arranged that an electric lamp of sufficient candle-power throws a ray through a filter passing 4100 to 4450° Angstrom units. This filtered light is led through two parallel tubes, each of them thus receiving the same amount of light. In the one tube the diameter is fixed; but in the other it can be made smaller or larger by means of a micrometer screw of a diaphragm controlling the amount of light passing through. Then the light from both tubes is united into two equal parts, half being illuminated by the light from one tube, and half by that from the other. If the illumination is equal, the two halves have the same tint, otherwise they have different intensities, just as in a half-shadow polarimeter. By rotating the micrometer, and consequently opening or closing the diaphragm, the amount of light from the one tube is modified, and one can thus adjust the apparatus to equilibrium. A cell containing the liquid under examination, to which the indicator has been added, is introduced into one tube, while in the other is placed, either water, or else the coloured or cloudy liquid itself, diluted with the volume of water corresponding to that of the indicator added. Equilibrium of tint is

[1] A theoretical descripton of this apparatus as a colorimeter and turbidimeter has already been given. See *I.S.J.*, 1931, 86. Dr. Geerligs now gives a useful account of its value for *pH* determination. It is in future to be known as the Pulfrich Gradation Photometer, the terms Stupho-Photometer and Step Photometer having been dropped. It costs £100 complete.

established by means of the micrometer screw, and the reading taken on a scale, after which by means of a table one finds the intensity and consequently the degree of acidity (*pH*) from the extinction thus measured. Calibration of the apparatus can be effected by using liquids of known *pH*, and one can thus very easily determine the *pH* to 0·05, finding, e.g., 7·15 in place of 7·20 *pH*, and that even in slightly cloudy liquids.

IMPROVED METHOD OF COVERING WITH WATER AT THE CENTRIFUGALS. **A. M. van Lom.** *Archief*, 1931, **39**, I, No. 5, 98-118.

By careful technique ensuring the most even distribution of the water over the surface of the sugar, it is possible to reduce the amount of crystal dissolved to the minimum. In experiments here described, a special sprayer was found to be much more advantageous than the cans ordinarily used. This sprayer was LECHLER's spiral atomizer,[1] which throws out the water in the form of a hollow cone, the wall of which, so thin is it, resembles a cloud. The degree of atomization naturally depends on the pressure used and is adjustable, but even under 2·5 metres a very good subdivision of the water is realized. In the tests described, a 36 in. electrically-driven centrifugal (one of the after-workers) was used, and the water for each charge was measured in a suitable meter with which the sprayer was connected. The sprayer was so held in the centrifugal by the operator as to ensure that the whole of the layer of sugar was covered with a fine cloud, though in practice of course provision would be made for its permanent fixture. The actual spinning occupied 7 min., and the water-covering 3 min., sugar, molasses and wash-syrup were weighed and analysed. A good number of tests were thus carried out, the results being summarized in 4 tables and 12 graphs. It is quite evident from all these that when the sprayer was used the amount of crystal dissolved per litre of water was much less than when the present system of using cans was followed.

Advantages of using the sprayer that were demonstrated were : (1) that for the removal of the same amount of non-sugar from the layer of sugar less water suffices than with cans ; and (2) that per litre of covering water less crystal is dissolved, and when the amount of water used was small, only 1 litre for example, there was a considerable difference between the two methods of covering, as is seen from the following table summarizing the results.

Water used. Litres.	Method of Covering	Dissolved Crystal, per 100 total non-sugar.	Composition of Sugar. Pol.	Composition of Sugar. Water per cent.
1	Sprayer	0·5	99·13	0·51
1	Can	1·3	99·05	0·56
2	Sprayer	1·8	99·22	0·47
2	Can	3·9	99·16	0·50
3	Sprayer	4·4	99·32	0·44
3	Can	10·0	99·24	0·47
4	Sprayer	11·6	99·36	0·42
4	Can	20·4	99·29	0·44

It is lastly remarked that in these tests the covering with the cans was applied with every care, whereas in practice the coolie when unobserved throws a couple of cans in the centrifugal anyhow. There is thus no uniform distribution of the water, and the efficiency of such a method is practically nil. On the other hand with a sprayer installation the workman has only to open the water inlet to ensure that covering proceeds in the proper manner.

1 The LECHLER sprayer is a German device much used in the beet sugar industry in Europe. It should also find use in cane factories for the application of imbibition water.

The Brussels Sugar Convention of 1931.

Official Summary of the Agreement.

The International Sugar Agreement signed in Brussels on May 9th is the first successful attempt to bring within the scope of a world-wide plan interests responsible for a commodity common to practically every household. The agreement applies to countries which control 80 per cent. of the total annual world exports and nearly 50 per cent. of sugar produced. Its purpose, briefly stated, is to restore a world industry representing an investment of several billion dollars to a measure of normality by re-establishing equilibrium between consumption and production.

By liquidating, over a period of approximately five years, an excess of about 2,500,000 tons of sugar now weighing upon world markets and causing unprecedented depression in the sugar industry, the Chadbourne Plan indicates a new method of solving present grave world commodity problems.

The Plan runs until September 1st, 1935, but there is nothing to prevent an extension beyond that date if signatories so desire.

The Plan is the outcome of the extended efforts of Mr. THOMAS L. CHADBOURNE and his associates and was initiated in Cuba with the approval of President MACHADO. The parties to it—Cuba, Java, Germany, Czechoslovakia, Poland, Hungary and Belgium—have all made very definite sacrifices in the interests of the agreement. A rigid system of export quotas, limiting signatories to a careful schedule of foreign sales during the life of the agreement and ensuring their execution by means of government legislation or special decrees, guarantees fulfilment.

An International Sugar Council, to be presided over by Mr. FRANCIS E. POWELL, one of the best known American business men in Europe, who for twenty years has been connected with important American interests abroad, will direct the destinies of the agreement. The Council will have its headquarters in The Hague and serve as an international clearing house for the participating countries.

Participants will be represented on the Council and cast votes in ratio to their importance in their industry. The total of 90 votes has been apportioned in the following manner :—

	Votes.
The Cuban Corporation	35
The Java Corporation	30
The Czechoslovakian Corporation ..	8
The German Corporation	6
The Polish Corporations, jointly ..	6
The Hungarian Corporation	3
The Belgian Producers, jointly ..	2
Total	90

The first meeting of the Council will be held on the second Monday in June, 1931.

The powers of the Council include :—

(1) The supervision of the operation of this Agreement.

(2) The collection of statistics and information respecting the production, consumption, stocks and requirements of the countries of the several parties to this Agreement, as well as all other countries.

(3) The study of the progress of retrogression of sugar consumption and the reasons therefor.

(4) The study of ways and means for the increase of the consumption of sugar in the world.

(5) The recommendation to parties to this Agreement of measures for the improvement, development and control of production and consumption.

(6) The publication, at regular intervals, of accurate statistics regarding the world situation of sugar, and to suggest to the parties steps to be taken respecting the adjustment of production with actual needs and exports, and to improve the method of selling and marketing.

Only three important exporting nations now remain outside the agreement. These are Russia, the Dominican Republic and Peru. Negotiations with the two latter countries have been under way for some time and will probably result in their adhesion. While Russia is potentially an important exporter of sugar, it is believed that the internal economic situation of that country during the next few years will serve to keep sugar exports at an unimportant minimum.

General provisions have been inserted which participants hope will bring prices to a level sufficient to return costs, including interest on investment.

The present price of sugar is approximately 1·25 cents per pound. To ensure cost plus a very small margin of profit, sugar must rise to more than 2 cents a pound. Under present conditions, no nation can export sugar at a profit at prevailing prices. Exporting producers are agreed, however, that to avoid a recurrence of the chaotic conditions prevailing in the sugar industry to-day it is necessary to discourage a flow of sugar from countries which do not normally export. The following system has therefore been devised to prevent such an occurrence.

When the world price of sugar reaches 2 cents, the respective annual quotas of each country shall be automatically increased 5 per cent. If the price reaches, for the prescribed period, 2¼ cents a pound, the International Sugar Council may, at its discretion but without obligation, increase the export quotas by an additional 2½ per cent. If, however, the said world price reaches 2½ cents, the Council shall increase the quotas respectively by an amount which, with the increase made after the price reaches 2¼ cents, shall equal 5 per cent. of the quotas. These prices will be considered to be reached whenever the average price, for a period of thirty consecutive market working days, shall be not less than the equivalent named.

By releasing these increased quotas, it is the expectation that the world price will be restrained to a figure discouraging new exports and guaranteeing a fair price to the consumer as well as a small margin of profit to the producer.

MODERN FERTILIZERS.—In a paragraph, printed in our February issue,[1] the composition of some of the I. G. fertilizers was given. Mention was also made of "Ammo-Phos," which is not one of the products of the I. G., but is made by the American Cyanamid Company from nitrogen fixed in the form of cyanamide at Niagara Falls, and from phosphoric acid obtained from Florida phosphates. It is put on the market in two grades: "A" containing 10·7 per cent. of nitrogen and 46 per cent. of available phosphoric acid, and "B" in which these two constituents are present in the amounts of 16·5 and 20 per cent. respectively. "Ammo-Phos" has now been on the market for some years, and has a well-established reputation as a fertilizer in tropical agriculture.

[1] *I.S.J.*, 1931, 63.

Trade Notices.

George Fletcher & Co. Ltd.—This well-known Derby firm of sugar machinery manufacturers have struck out a fresh line in trade pamphlets that has much to recommend it. Mr. Cecil W. Murray, A.M.I.Mech.E., has prepared a well illustrated brochure, entitled "True Economy in a Cane Sugar Factory," which is addressed largely to the owners of smaller or not fully-equipped sugar factories with the idea of pointing out to them the advantages of having their factories properly balanced in their operation. It will not interest the owner or engineer of a well-equipped plant; but, after all, if the plant is already perfect, there is nothing more to interest them. The interested reader is, however, taken as it were through the factory and the advantages of adopting a number of suggested improvements at the different stages of manufacture are succinctly pointed out. The key note of the argument is that the efficiency of the equipment of a factory must be measured, not by the cost of the installation but by the cost per ton of sugar produced, and that by the making of even minor alterations in a partially obsolete factory, costs per ton can be reduced sufficiently to compare favourably with those of newer concerns. Messrs. Geo. Fletcher & Co. will be pleased to supply free copies of this pamphlet to all interested. Incidentally, Spanish and Portuguese editions will shortly be available for those who prefer them.

Worthington Pump & Machinery Corporation.—This Corporation had a most successful year during 1930, in spite of the economic conditions, having made 97 per cent. of its sales quota. The net income for the year was $2,056,093 on an issued capital of nearly 29 million dollars. With a surplus at January 1st, 1930 of $5,659,169, the total available for dividends amounted to $7,715,263. Out of this $2,021,597 was applied to preferred stock dividends and the balance of $5,693,665 carried forward into 1931. Unfilled orders at December 31st, 1930, amounted to $4,529,060, which is an increase over the amount at the beginning of the year. During 1930 more than $630,000 was expended in the improvement of manufacturing facilities and in the purchase of new tools and equipment, while many improvements in products manufactured have resulted from research and engineering activities. A new Vice-President has been lately appointed in the person of Mr. H. C. Beaver, formerly Executive Vice-President of Rolls-Royce of America, who will devote his efforts principally to the administration of the Sales Department.

Oliver Cane Mud Filters.—During the last two cane grinding seasons some notably economical work on filtering cane mud by Oliver-United cane mud filters has attracted attention. A number of installations have been put to work in the Caribbean region, in South America, Mexico, and the Philippine Islands, the latest ones being of the Oliver-Campbell type, using perforated brass plates for a filter medium on the drum surface. Wherever tried, it is stated that the operators concur in finding automatic operation (combined with low polarization filter-cake), and low operating costs. As a result of these trials, orders have come to hand from other quarters for installations of these filters, including one from Hawaii.

Werkspoor Rapid Crystallizers.—Prospectus 39. (Werkspoor N.V., Amsterdam, Holland; London Agents, Anglo-Hollandia Machineries Ltd., Mitre St., Leadenhall St., London, E.C.3.). 1931. Gratis on application.

Some useful notes on crystallization generally are to be found in this bulletin on the "Werkspoor" crystallizer which was recently described in our columns.[1] These discuss the modern system of rapidly cooling high and low grade massecuites. They also describe the manner in which such rapid crystallization is best performed, using the Werkspoor continuous apparatus, now working in various factories in Java. Interesting data well illustrated on this subject of general importance are given in this useful publication, which should be in the hands of sugar factory executives.

[1] *I.S.J.*, 1930, 306.

Publications Received.

Methods of Chemical Control for Cane Sugar Factories. (Association of Hawaiian Sugar Technologists, Honolulu, T.H.). 1931. Price : $3·00.

These Hawaiian methods were last published in 1924.[1] This new edition has been subjected to revision by a Committee, who have assigned the various chapters to different members for their special attention. One can understand, therefore, that the re-editing has been carried out with thoroughness. In general the arrangement of the book is as before, but two chapters have been omitted, and three new ones now appear.

In the chapter on " Definitions " normal juice becomes absolute juice, other new definitions adopted being tonnage fibre ratio, cane ratio, and sugar ratio. Under the heading of " Apparatus " the excellent matter on the construction, use, and care of the polariscope is retained, and is even improved with some few additions here and there. As the standard of volume for glassware, the millilitre is now adopted, the temperature for calibration remaining at 27½°C. SPENCER'S oven is particularly recommended for the very rapid determination of water. NORRIS' handy bagasse digester is still to be used for sucrose in bagasse determinations, though a short description is now given of the SPENCER rotary digester. Another new piece of apparatus mentioned is the KOPKE turbidimeter.

The chapter on " Weights and Measurements " remains substantially the same. That on " Sampling " now includes accounts of new automatic juice and sugar samplers. "Methods of Analysis" is largely the same. In this last, one finds WALKER'S double polarization method still used. For glucose determinations, the MUNSON method is again recommended ; but EYNON and LANE'S volumetric method replaces the rather approximate process previously prescribed. In this chapter the carbonate method of determining ash is still advised in preference to the sulphate method (almost generally used elsewhere), and if the latter is used then the deduction recommended is 20 or 25 per cent. and not 10 per cent. But no mention is made of conductimetric methods now used elsewhere, for the rapid and accurate determination of ash. A new chapter is given on " Special Analyses," the material in it concerning the determination of turbidity and of phosphoric acid in juices, flue gas analysis, dry crushing tests, and the ELLIOTT test on the filtration rate of raw sugar.

Another new chapter is that on the determination of the *pH* value. Colorimetric procedure using H.S.P.A. charts is described ; but it is said that " electrometric methods are now accurate, and when used with proper precautions are preferable to colorimetric methods," which is true. A good account with a useful sketch appears of apparatus using the calomel half-cell and quinhydrone electrode with N/10 KCl solution. " Calculations for Mill Control " have been brought up-to-date, and the chapter on " Stock and Recovery Balance," a new one, contains useful data for reporting so as to ensure a uniform scheme. " Field Distribution " gives attention to the calculation of recoverable sugar from the pol. in cane and the sugar ratio. The chapter on " Distillery Control " is now omitted. There has also been some revision of the tables. New ones are included covering cane ratio, sugar ratio, *pH* values, and glucose. In reading the book it is evident that the revision has been conducted with much care. It is indeed certain that these excellent " Methods " will be given attention by chemists in countries other than Hawaii.

De Rietsuikerindustrie in de Verschillende Landen van Productie. H. C. Prinsen Geerligs. Supplement op den 2 druk. (J. H. de Bussy, Amsterdam). 1931.

This book by Dr. H. C. PRINSEN GEERLIGS was first published in 1911, and in the following year an English edition appeared under the title of " The World's Cane Sugar Industry." A second Dutch edition was issued in 1924 ; and now we have a supplement to it. This brings the author's coherent survey of the past, present, and probable future of the cane sugar industry in the different countries of production quite up-to-date ; and thus completes a very valuable work of reference.

[1] *I.S.J.*, 1924, 551.

Publications Received.

Lunge and Keane's Technical Methods of Chemical Analysis. Second Edition; edited by Charles A. Keane, D.Sc., Ph.D. and P. C. L. Thorne, M.A., M.Sc., PhD. Volume III. (Gurney and Jackson, London). 1931. Price: £3. 3s. nett.

LUNGE and KEANE's volumes are now well known as standard textbooks to which the analyst turns when seeking the latest, most reliable information on technical methods of chemical analysis. Their value has been pointed out by us when noticing previous editions. Volume III, of the second edition, which has just appeared, contains much of value to the chemist engaged in sugar estate work. There are, for example, sections on "Drinking Water and Water Supplies" by GILBERT J. FOWLER, D.Sc., F.I.C., lately Principal of the Harcourt Butler Technological Institute, Cawnpore, India; on "Sewage and Effluents" by the same writer; on "Feed Water for Boilers," by L. O. NEWTON; on "Fertilizers" and "Feeding Stuffs" by BERNARD DYER, D.Sc., F.I.C.; and on "Soils" by Sir DANIEL HALL, K.C.B., Sc.D., F.R.S., who was formerly director of the Rothamsted Experimental Station. Other sections deal with "Clays" and "Cements." Under Dr. KEANE's editorship the "Methods" have acquired the highest reputation for accuracy and clearness of description. Compared with the previous edition, this volume depends still less on the German manual which originally inspired its publication, being now entirely representative of British technical analytical practice.

Manufacture of Insulating Board from Cornstalks. O. R. Sweeney and W. E. Emley. Miscellaneous Publication No. 112. (U.S. Government Printing Office, Washington). 1930. Price: 10 cents.

A preliminary notice regarding this Bulletin, of possible interest to those considering methods for the utilization of bagasse for the manufacture of fibre board, has already appeared.[1] It points out that insulating boards made of materials other than cornstalks and bagasse, such as wheat straw, licorice-root waste, sawmill waste, ground wood screenings, etc., have been on the market for some years. There appears to be no particular difficulty about the manufacture of such material technically. While developed primarily as insulating materials, these boards have found many other uses, being now used in competition with lumber as sheathing and roofing for houses. Useful data are presented regarding the probable cost of manufacture of such boarding, the equipment, labour and power required, and the possibilities of marketing it.

English and Spanish Nomenclature of Farrel Cane Grinding Machinery. J. de D. Tejada. (Farrel Foundry and Machine Co., Ansonia, Conn., U.S.A.).

This is a useful English-Spanish and Spanish-English dictionary of words and terms most commonly used in connexion with cane milling plant. Most of the terms given are universal, while others are used locally in Cuba. It will be found of distinct value by erecting engineers and others in Spanish-speaking countries.

A Study of the Production of Activated Carbon. A. C. Fieldner, R. E. Hall and A. E. Galloway. Technical Paper 479; Bureau of Mines; U.S. Department of Commerce. (U.S. Goverment Printing Office, Washington). 1930. Price: 10 cents.

Although the product in view was a gas-mask carbon, the experiments here described have some interest to those studying methods for the manufacture of high-power decolorizing carbons for tropical refining purposes. A small silica tube, heated electrically, and holding a charge of about 40 grms. of carbon, was used, twice the weight of the carbon of steam being passed through during an hour at a temperature of about 900-925°C. Various woods, shells, coals, cokes, and blacks were submitted to this treatment. Anthracite having the highest carbon content, and the lowest ash, volatile matter and sulphur contents, gave the best results (according to the chlorpicrin and iodine absorption tests).

[1] *I.S.J.*, 1931, 186.

Brevities.

REFINED ENTERING U.S.A.—During 1930 the refined sugar entering the U.S.A. from Porto Rico, Hawaii and the Philippines reached the record of 109,644 tons, having been only 55,088 tons in the previous year. This is 5 per cent. of the total sugar entering the U.S.A. The refined from foreign territories, mostly Cuba, was 248,154 tons for 1930 and 239,243 tons in 1929. Cuba's refined importation, in fact, formed 10·13 per cent. of her total U.S. export in 1930 and 6·60 per cent. in 1929.

FRENCH BEET PRODUCTION.—In the following table the results of the 1930 sugar beet season in France are compared with those of the preceding years.[1]

	1930	1929	Aver. 1924-28	Percentages 1929 = 100	Percentages Aver. = 100
Area ....(1000 acres)	646	607	563	106·4	114·7
Production, Roots (1000 sh. tons)..	9,716	5,910	5,957	164·4	163·1
Yield ....(sh. tons per acre) ..	15·0	9·7	10·6	153·2	140·9

PUSA SUGAR BUREAU UNDER NEW CONTROL.—It is announced that as a consequence of the Government of India orders of 3rd March, 1931, the administrative control of the Sugar Bureau and Sugar Cable Service at Pusa, Bihar, will be transferred to the Imperial Council of Agricultural Research in India, under which the Sugar Technologist to the Council will deal with the technical work connected with the Sugar Bureau from 1st April, 1931. The address of the new headquarters is: The Sugar Technologist to the Imperial Council of Agricultural Research in India, Cawnpore, U.P., India.

CARBON REFINING.—In order to reply to questions asking for further information on his recent article dealing with refining by means of carbons on the plantation,[2] Mr. N. E. Lamont asks us to state that in his method of working, known locally as the Lamont process, the carbons used are either "SumaCarb" or "Carboraffin," which are applied in an easy and economical way without revivification. Excepting the excellent "Auto" filter, the plant used is of British origin, having been supplied by George Fletcher & Co., Ltd., and Pott, Cassels and Williamson. The refined sugar made is the equivalent of the best char-treated product.

OFFICIAL ACTION AGAINST U.S. SUGAR INSTITUTE.—It is reported from New York that the Department of Justice has filed a petition in the Federal Court asking for the dissolution of the Sugar Institute, Inc., on the alleged grounds that for the last three years they have maintained "a comprehensive plan designed to fix oppressive and uniform prices for refined sugar." The charge is made under the Anti-trust Laws. The Sugar Institute, now in its fourth year and comprising all the cane refiners, producing some 85 per cent. of the sugar consumed in the States, claims that its cardinal principle is that sugar should be sold by refiners upon open prices and terms publicly announced and without discrimination between buyers; and it professes to welcome the opportunity of having the Courts determine finally the correctness of the course which has been followed.

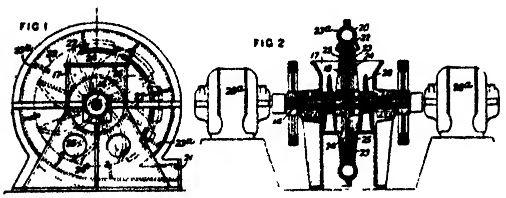
AMSTERDAM EXHIBITION.—An International Exhibition in connexion with the sugar industry was held in Amsterdam, 10th to 26th April, and following were some of the principal firms which were there represented: Wed. P. Smits & Zn. (Bonechar, sulphate of ammonia, etc.); Gebr. Dreibholz & Co. (beet knives and accessories); Gebr. Van Gilse (sugar candy, syrups, etc.); N. V. Centrale Suikermaatschappij (sugars and syrups); Fredr. Boehm, Ltd. (invert sugar, invertase); N. V. Norit Vereeniging (vegetable active carbons for decolorization, and water purification); N. V. Stijfsel-en Glucosefabriek "Sas van Gent" (glucose, dextrin); N. V. Corn Products Co. (dextrose, glucose); Anti-Cromos (decolorizing carbon); N. V. Machinefabriek Gebr. Stork & Co. (sugar machinery); N. V. Nederl. Elite Zaad Mij. (beet seed); Proefstation voor de Javasuikerindustrie filiaal Nederland (charts and pictures relating to sugar production, tubes showing the quantities of sugar consumed per head per week in different countries, etc, etc.,); Fr. Hesser A.-G. (automatic packing machinery).

1 From *Int. Review of Agriculture.*   2 *I.S.J.*, 1930, 629.

Review of Current Technical Literature.[1]

Morgan Cane Disintegrator. L. S. **Clark.** *Proceedings of the Fourth Annual Conference of the Association of Sugar Technologists of Cuba,* 1930.

Essentially it is a disc of high-grade plate steel mounted on a horizontal shaft, and revolving within a semi-steel casing.[2] Into radial slots in the sides of the disc are set alloy steel bars, so-called knives, of square cross section. This combination of shaft and disc forms one half of the cutting apparatus. The other half is made up of a cast steel casing which carries proper bearings for the rotor shaft. There are radial slots in the inner surface of the casing, into which are placed alloy steel bars of exact square cross section, similar to those in the disc. In the periphery of this interior is a circular space through which travel pins fixed at intervals on the edge of the disc, these pins carrying the disintegrated cane around the casing to the discharge opening at the bottom. The shaft, set into Timken bearings, is driven through flexible couplings by motors suited to the capacity. Disc and shaft may be adjusted axially with respect to the face of the blades fixed in the housing. The range of adjustment is such that the alloy steel blades may be made to rub as the rotor turns, or they may be separated to any number of thousandths of an inch, up to 250.



With a set of knives on each side of the disc, and with the corresponding sets in the interior faces of the casing, there are in reality twin cutting machines embodied in one unit. Integral with the casing and adjacent to it on both sides is a cast-iron straight-sided hopper, the outside of the casing forming one side of this hopper, while the rotor shaft passes through its bottom. A heavy single-turn worm which is attached to the shaft pushes toward and into the interior anything that drops into the hopper. Depending upon the size of the unit, the disc makes 600 or more revs. per min. Cane dropped into the hopper is pushed to the interior and sheared into filaments as the disc blades move rapidly past the fixed casing blades. At 600 revs. per min. each of the 8 moving edges passes 4800 fixed knife edges per min. The steel pins fixed in the peripheral edge of the disc carry the disintegrated cane circumferentially through the peripheral annular space in the interior of the casing to the discharge opening at the lowest point, where it drops to a conveyor. It is not practical to feed whole or even large pieces of cane into the hopper without a great deal of resistance by tangling and bridging; so that the Morgan should be preceded by a single set of cane knives, which, besides permitting a uniform feeding, makes up an ideal bed from which tramp iron may be withdrawn by the electro-magnet which is a part of the Morgan installation. With the disintegrator milling is changed from heavy crushing and grinding to simple squeezing and washing. Final bagasse is obtained having a sucrose content of "just slightly above 2 per cent., and often below this figure, exceptional in Cuba." At the Hershey Central, where it is operating, the final bagasse has a water content of 46 per cent., and sometimes lower. Claims made are: That the whole tandem uses less power for a given tonnage of cane; and that maintenance of the tandem itself, and especially of the mill rolls, both in material and labour, is reduced to a small fraction of currently accepted figures.

Production of Alpha-Cellulose from Bagasse in Cuba. **Joaquín de la Roza.** *Proceedings of the Fourth Annual Conference of the Association of Sugar Technologists of Cuba,* 1930.

When President Machado was presented last August with the first material to be made from the cellulose of bagasse, viz., a pair of ladies rayon hose, "there came to a successful close a long chapter of basic research and development, and officially a new industry was born in Cuba." Now α-cellulose can be made from bagasse

 [2] For patents, see *I.S.J.*, 1927, 392. Also 1929, 441; 1930, 270.

in the form of white sheets which are used by the artificial silk manufacturer as raw material in competition with that made from cotton. It is very doubtful if the fibre of bagasse contains much more than 40 per cent. of α-cellulose, though beta, gamma, oxy and other degraded celluloses may be present in greater or less proportion. Analytical methods used for its isolation from cane fibre consist of a series of mild chemical treatments designed to destroy or modify non-cellulosic substances; but it is obvious that such methods besides being impracticable are too expensive to be used for the commercial production of this material. Success in developing suitable technical processes have been due, says the writer, perhaps more to faith and necessity than to anything else. That is, faith in the fact that bagasse is the world's cheapest and most plentiful source of cellulose, and the necessity of developing commercially this product of our industry to enable it to meet the inroads of competition and adverse legislation.

Since the author's first patents were filed in Cuba in 1925, the process developed in the laboratory has been transferred into a commercial reality on a very large scale. Conveying bagasse over long distances, for example, has been solved by blowing it through pipes of large diameter. Organic acids formed by the decomposition of sugar, said not to attack iron and steel, were found to be corrosive, and monel metal had to be used. After several years of work, at the plant at Central Tuinicu, the technical difficulties were finally overcome, and it was possible to produce a sufficient tonnage of "Alpha Celulose Cubana" containing an average of 97 per cent. of the actual α-compound for shipment to various mills in the United States for trial in large scale demonstrations. Those tests proved that the α-cellulose made in Cuba as a competitor to purified cotton linters has become an accomplished fact, so that "the new industry Celulosa will soon be the support of its sick sister sucrose." (Patents dealing with Cellulose, taken out by the author of this paper, have been noticed by us.[1] One of these describes the following procedure: "Preferably the fibre is crushed and washed in hot water before treatment with sulphurous acid while the succeeding alkaline treatments may follow immediately, or later. Subsequent to the acid treatment, the fibre is washed in hot water and treated with a dilute solution of potassium or sodium hydroxide under pressure at from 140-170°C. It is finally washed and bleached. Alternatively, the alkali may be at atmospheric pressure, and below 100°C., the fibrous material being subsequently beaten in a pulping engine."—ED.)

STEAMING OUT *vs.* WASHING OUT PANS. **Juan Gonzalo Salinas.** *Proceedings of the Fourth Annual Conference of the Association of Sugar Technologists of Cuba,* 1930.

It is very general practice after the strike has been dropped to clean out the pan with live steam to free it of sugar. This operation produces a characteristic odour, agreeable to many, due to the formation of caramel products from the sugar at the high temperature resulting from the steam used. Glucose first arises, then a series of decomposition products, not yet well studied, as glucinic, apoglucinic, humic, formic and saccharic acids. These organic acids form calcium and magnesium salts having intense colouring properties, which are the cause of the characteristic darkening of the massecuites, besides being strongly molassigenic. Experiments were conducted by the author over a period of two weeks for the purpose of estimating the advantages compared with steaming-out or washing-out with hot water from a circular spray discharged from above against the inside of the walls of the pan body, the washings discharging into the molasses receiving tank of the first or second centrifugals. On initiating this *modus operandi* the first observation was that the amount of the washings from each strike did not increase noticeably the amount of first molasses serving as a diluting agent to reduce the density of the pure molasses from the centrifugals to 30°Bé., the concentration being used. By distributing properly the water injected under pressure into the pan, the washing was as effective as steaming-out while avoiding the very prejudicial caramelization entirely.

In fact, from the first the cleaning was very satisfactory, there remaining in the pans no appreciable signs of grain, except on some parts of the coil and calandria sur-

[1] *I.S.J.*, 1929, 107; 1930, 221.

faces, where the water had not reached. Improved technique in this direction could be developed. But the principal observations were that the mahogany or caramel colour disappeared from the low-grade massecuites, these assuming a uniform dark walnut; that their purging was effected comparatively rapidly; that the risk of smearing in the massecuite during cooling was reduced; and that the amount of final molasses produced was noticeably reduced. Following are some data on the results obtained with the steam and water methods of washing out the pans:—

USING STEAM.

Massecuite.	No. of Strikes.	Vacuum.	M-C Purity.	Colour.	Cooling Time. Hours.	Molasses Purity.
First (A)	32	25·75	78·80	105	3 to 4	55·50
Second (B)	22	25·75	70·90	105	5 „ 6	48·20
Intermediate	16	25·75	65·20	120	8 „ 10	40·60
Third (C)	10	26·00	56·20	135	17 „ 20	31·20

Average Purity of Normal Juice: 83·60.

USING HOT WATER.

Massecuite.	No. of Strikes.	Vacuum.	M-C Purity.	Colour.	Cooling Time. Hours.	Molasses Purity.
First (A)	40	25·70	77·85	100	3 to 4	54·20
Second (B)	29	25·70	71·20	100	4 „ 5	48·30
Intermediate	20	25·70	66·10	105	8 „ 9	39·20
Third (C)	11	26·00	55·30	110	12 „ 15	28·20

Average Purity of Normal Juice: 83·95.

AMOUNTS OF MASSECUITE, MOLASSES AND SUGAR AT THE PAN STATION WITH DIFFERENT BOILING SYSTEMS. **A. L. Webre.** *Proceedings of the Fourth Annual Conference of the Association of Sugar Technologists of Cuba*, 1930.

In the operation of vacuum pans the distribution of work and loads for the various strikes as the purity of the initial syrup varies has always been a vexing problem. In the past these determinations have been made mostly by approximations based on previous experience. As a rule this has not been satisfactory. It is the object of the author's book entitled "Massecuite, Molasses and Sugar," which was recently published,[1] to clarify this subject, and to provide a rational answer to the questions that arise relating to two, three, and four boiling systems. There is, for example, the simple two boiling system in which grain made from syrup is used as a starting point for both the first and second strikes, both sugars going out as commercial 96°test. There is the two boiling system with *B*-seed, in which the second or *B*-sugar is used as grain for the first or *A*-strike, all the commercial 96° sugar coming from the *A*-strike. There is the three boiling system with syrup, in which first, second and third sugars are turned out at 96° test. Again, there is the three boiling system in which *C*-sugar is used as seed for the *A* and *B* strikes, the outgoing 96° test sugar being all made up of *A* and *B* sugars, the method in common use in Cuba. Then there is the so-called four boiling system, in which there are four successive strikes, a method used by few factories in Cuba, and not included in this study.

As can be realized, the amount of work involved in solving problems connected with various boiling systems demands a deal of time, and such calculations cannot be done hurriedly on the spur of the moment. It is necessary to be sure of one's premises, and particularly certain of the various massecuite and molasses purities. In arriving at these, the author consulted many of his friends in the industry, besides referring to many records, and believes that the foundation of his work is sound. Flow sheets have been calculated for five syrup purities in each of the boiling systems studied, and curves have been plotted from which interpolations can be made for all intermediate purity values. Data are correct only to slide-rule accuracy, which should fully answer the purpose in view. In the past there have been many discussions of the relative merits of the boiling systems outlined above, and in this book it is believed that a satisfactory answer will be found to the questions that usually arise, the charts plainly showing direct comparisons of the salient features of each. Using this book it is possible to determine quickly and with fair accuracy

[1] *I.S.J.*, 1931, 139. It is published by the United States Pipe and Foundry Company, Burlington New Jersey, U.S.A.; and, we understand, is for free distribution.

the amounts, both by weight and by volume, of different massecuites and molasses obtained for any load and any purity of syrup one is likely to meet. It is also possible quickly to determine how much sugar will be made, and thus the yield. This book, therefore, provides much useful information, and fulfils the object stated in the preface, namely " to give a brief and clear survey of the distribution of products entering and leaving the pan station of the ordinary Cuban raw sugar factory under normal operation, the use of both the two boiling and three boiling systems being contemplated with or without the utilization of low-grade sugars as seed for the high-grade strikes."

VITAMINS IN SUGAR CANE JUICE, SYRUPS, AND MOLASSES. **E. M. Nelson and D. Breese Jones.** *Journal of Agricultural Research*, 1930, 41, No. 10, 749-759. Experiments showed sugar cane juice to be a poor source of the anti-neuritic vitamin. It contains a small amount only of vitamin-*A*, and little if any vitamin-*D*. Cane syrup, Louisiana and Porto Rico blackstrap molasses, and " Cane Cream," were found to be " devoid of demonstrable quantities of vitamin-*B*."[1]—COMMERCIAL PRODUCTION OF GLUCOSE. **A. E. Williams.** *Industrial Chemist*, 1930, 495-499. An outline is given of the hydrolysis of the starch, neutralization, decolorization, concentration, and crystallization. To obtain the monohydrate crystals, the syrup is cooled to 34-36°C., and the pans " seeded " with mono-hydrate crystals from a previous batch. Anhydrous crystals are produced in a similar manner, reducing the temperature to 25°C., and using the anhydrous crystals for seeding. A good crop of crystals is induced by gentle stirring with a wooden paddle, the rotation of which should not exceed 4 revs. per min. Crystal dextrose has a purity up to 99·5 per cent. " A U.S.A. patent[2] claims to make glucose on a large scale, having 100 per cent. purity, but it may be necessary to accept this statement with reserve."—TURBIDIMETER. **S. W. Parr and W. D. Staley.** *Ind. & Eng. Chem.*, 1931, 3, No. 1, 66. This instrument (somewhat on the lines of a Stammer colorimeter) costing about £8 is being used for the determination of small amounts of sulphur in fuels and boiler feed-waters, the turbidity of the barium sulphate precipitated in a given volume being matched against that of a standard liquid treated under like conditions. A determination of SO_3 can be carried out in several minutes (it is claimed) with an accuracy comparable to that obtained in the gravimetric method.—PREPARATION OF ABSOLUTE ALCOHOL IN THE LABORATORY. **Hakon Lund and Jannik Bjerrum.** *Berichte*, 1931, 64, 210. 5 grms. of magnesium ribbon are placed in a flask connected to a reflux condenser; 50 to 75 c.c. of at least 99 per cent. alcohol are poured on, and then 0·5 grms. of iodine are added. The flask is warmed until the iodine has disappeared. If there is a vigorous evolution of hydrogen, a further 0·5 grms. of iodine is added, until the whole of the magnesium is converted into ethylate; 900 c.c. of commercial 96 per cent. alcohol to be dehydrated is added, and the whole boiled for half-an-hour under the reflux condenser. On distillation, perfectly anydrous alcohol is obtained, and a residue of magnesium hydroxide and ethylate remains behind.—" AGELINDUS " DAYLIGHT LAMP. **Alfred Salmony.** *Centr. Zuckerind.*, 1930, 38, No. 49, 1331. In this lamp, consisting of a Geissler tube filled with CO_2, a practical and reliable source of light closely matching sunlight is found. It is claimed even to have preference over natural light, as it allows of the finer shades to be distinguished better. In percentages of red, green and blue, it gives 32½, 34½, 33½ ; direct sunlight, 37½, 32½, 30 ; " Nitra " daylight lamp, 46, 30, 24 ; but ordinary electric light, 63, 24, 18. Such a lamp should be of value in the sugar industry for test-paper work, buffers *pH* matching, comparing the colour of juices and liquors, for examining sugars, and the like. A tube lasts 1500 hours.

---

1 One recalls that in 1925 much interest was aroused by the publication of results by officials of the Iowa State College showing that cane molasses was "rich in Vitamin-B." Yet two of the samples of blackstrap examined in the present investigation contained none of this vitamin at all. It is hoped that the work will shortly be continued by others so as to arrive at more conclusive results in view of the importance of cane syrups and molasses as a food for both human and animal consumption. See *I.S.J.*, 1925, 139.

2 U.S. Patent, 1,471, 346 of 1923; see *I.S.J.*, 1924, 285.

Review of Recent Patents.[1]

UNITED STATES.

Cane Crushing Apparatus (Shredding Roll). **Francis Maxwell, of Wallington, Surrey.** 1,781,186. November 11th, 1930.

The cane crushing apparatus of this invention contemplates the use of a new and improved form of shredding roll, in combination with a pair of pressure rollers which may be grooved or not, as desired. The machine illustrated, is similar in type to the inventor's co-pending application, Serial No. 623,847, filed March 9th, 1923. In addition to these, and in combination therewith, a novel form of shredding roll having a novel form of teeth thereon by the use of which more efficient shredding of the cane is obtained, is also contemplated. The principal object of this invention is to provide in cane crushing apparatus, an improved and efficient form of shredding roll. It is illustrated in Figs. 10, 11, 12 and 13.

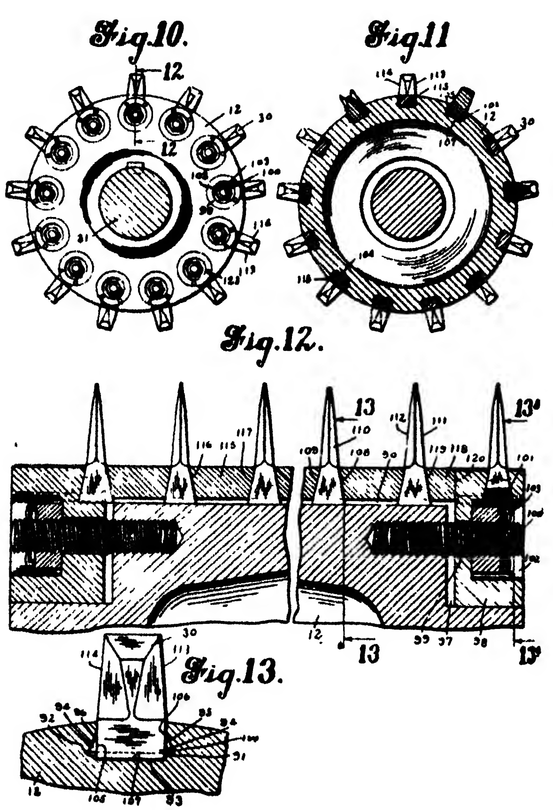


Fig. 10. Fig. 11. Fig. 12. Fig. 13.

What the inventor claims is (1) In cane crushing apparatus, a roller having a groove extending lengthwise thereof, a series of spacing blocks slidably retained to the roller in the groove therein, teeth between said blocks, said teeth being of increased width at their bottoms in the direction of the spacing blocks, said spacing blocks being shaped to fit the lower ends of the tooth and adapted to engage said teeth to secure them to said roller. (2) In cane crushing apparatus, a roller having a groove extending lengthwise thereof, and an opening in the end thereof communicating with the groove, spacing blocks in the groove, teeth between the spacing blocks, said teeth being provided with ends diverging in the direction of the spacing blocks, and means in the end opening of said roller adapted to clamp the blocks and teeth together to secure the teeth to said roller. (3) A cane working roller, comprising a cylindrical body having a longitudinally extending groove in the periphery thereof and opening radially outwardly, a pluralty of teeth insertable radially into said groove, a plurality of spacing blocks shaped to fit said groove, and insertable longitudinally thereinto, a space block between each tooth and the next, and means at the end of

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

said roller to clamp said teeth and blocks together in the groove to secure the teeth to the roller.

(4) In cane crushing apparatus, a roller having a plurality of removable teeth extending from the periphery thereof, each of said teeth having a base portion, the base portion of each tooth being adapted to radially enter an opening in said roller, and means to secure the teeth to said roller, said means being slidably engaged by said roller and adapted to clampingly engage the base portion of said teeth. (5) In cane crushing apparatus, a roller having a plurality of removable teeth extending from the periphery thereof, each of said teeth having a base portion, the base portion of each tooth being adapted to radially enter an opening in said roller, a space block between each pair of said teeth, said space block being slidably engaged by said roller and being adapted to engage said base portion of each of the adjacent teeth to secure them to said roller. (6) A tooth for a cane working roller, said tooth having a base portion and a blade portion, said base portion having longitudinally extending straight edges and tapering sides, said blade portion having longitudinally extending cutting edges and sides, the cutting edges of said blade portion merging into the straight edges of said base portion, and the sides of said blade portion merging into the tapering sides of said base portion. (7) A tooth for a cane working roller, said tooth having a base portion and a blade portion, said base portion having longitudinally extending straight edges and tapering sides, said blade portion having longitudinally extending cutting edges and sides, the cutting edges of said blade portion merging into the straight edges of said base portion, and the sides of said blade portion merging into the tapering sides of said base portion, and a cutting edge across the outer end of said blade portion interconnecting the longitudinally extending cutting edges thereof.

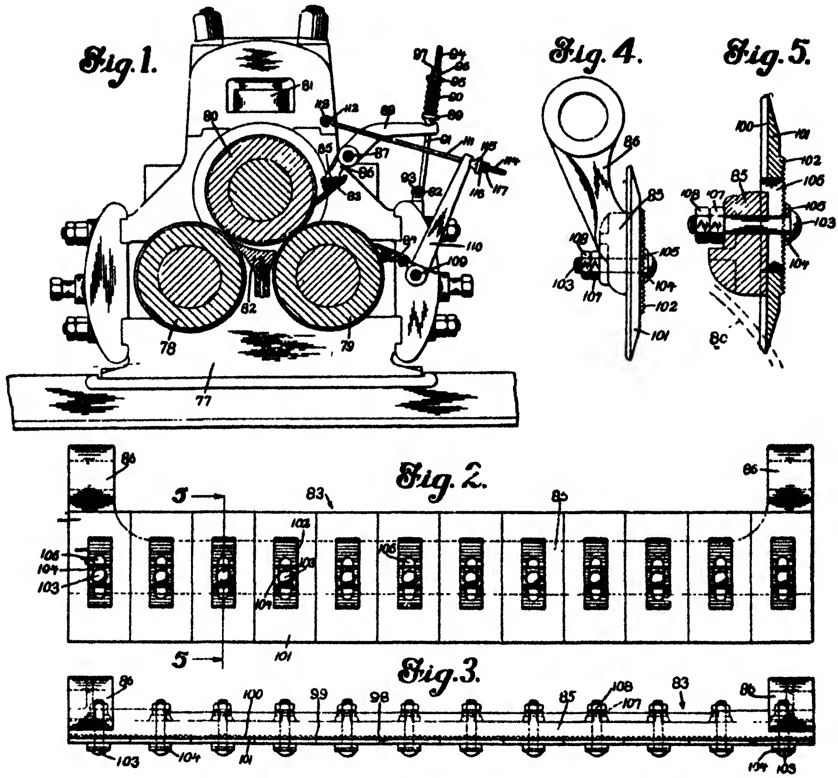
ROLL SCRAPER. **William Dunn**, of Macabi, Cuba. 1,787,937. January 6th, 1931.

Regarding scrapers for the circumferential ribs of rollers, in order that contact throughout its length may be maintained, it is customary to give each the requisite shape before it is placed in the mill, and to finish shaping it by urging it against the roll with which it is intended to be used, the roll wearing off the "high spots." One of the objects of the scraper here described is to eliminate this grinding or obviate it to a considerable extent; another is readily to replace broken teeth. Referring to Fig. 1, to remove cane adhering to the top roll 80 and bagasse roll 79, scrapers designated by 83 and 84 are provided. Fig. 2 shows a plan of this scraper, Fig. 3 its front elevation, Fig. 4 an end view, and Fig. 5 a sectional view along 5-5 of Fig. 2.

The scraper 83 is mounted on a bar 85 substantially equal in length to the length of the operative surface of the roll 80, and having at both ends thereof arms 86 pivotally supported on frame 77 by suitable means, as, for example, rod 87, the latter being pivotally supported in frame 77 and secured to arms 86 in any desired manner. The roll 80 adjusts itself towards and away from rolls 79, according to the amount of cane passing between these rolls, and in order that scraper 83 may be in contact with roll 80 at all times it is the usual practice, as in the crusher described above, to provide a spring, or other suitable means co-operating with the scraper and urging it against the roll. A suitable means to this end may be provided by an arm 88 secured to the rod 87 in any usual or desired manner, and engaged by spring follower 89, acted on by compression spring 90, mounted on rod 91, the latter having on one end thereof a hook 92, engaging a pin 93 in frame 77 and having its opposite end 94 provided with threads and passing through follower 89 and spring 90. Mounted on the end 94 of rod 91 in contact with spring 90 is a washer 95, secured against displacement by an adjustable nut 96, locked on rod 91 by lock nut 97.

The under-face 98 of bar 85 is provided substantially throughout its length with transverse grooves 99 (Fig. 3), in which are received substantially V-shaped ribs 100 of scraper plate sections 101, each of the latter being substantially identical, having on its outer surface a series of relatively fine transverse grooves 102, and being secured to the bar 85 by means of a bolt 103, passing through a washer 104, having a series of parallel ribs 105 adapted to enter grooves 102, through slot 106, through bar 85, and having on its outer end nuts 107 and 108, which serve to clamp the scraper section securely in place. Scraper 84 which is substantially identical to scraper 83 is

pivotally supported on frame 77, by means of rod 109, and is held against roll 79 by means of arm 110, secured on rod 109 in any suitable manner, and held against outward movement by means of rod 111 pivotally supported on frame 77, by pin 112, in engagement with hook 113 on rod 111. The opposite end of rod 111 from hook 113 is threaded, as at 114, and mounted on this end is a collar 115, engaging arm 110, and secured against displacement by an adjustable nut 116, and lock-nut 117. The scraper sections 101 may be independently adjusted towards and away from the rolls



with which they co-operate in much the same manner as the scraper sections provided for the crusher rolls, the ribs provided on the opposite faces of the sections 101 providing means for rigidly securing the sections to their adjacent support. When the scraper sections 101 are worn in, teeth will be formed on the roll engaging edge portions of the sections, which enter the grooves in the mill rolls to remove any cane adhering therein.

PLANT (FOR BEET, CANE, ETC.). **Charles Camuset,** of Bretigny-sur-Orge, France. 1,782,603. November 25th, 1930. A continuous diffusion process comprises a receptacle for the material to be exhausted, a number of substantially vertical diffusers, means whereby the said material is circulated through said receptacle and said diffusers in a continuous manner and in one direction from said receptacle to the last diffuser, means for feeding exhausting liquid in the last diffuser at the exit end of said material, connecting means between the diffusers and between the first diffuser and said receptacle adapted to allow said exhausting liquid to flow successively in a continuous manner from the last diffuser to said receptacle and in an opposite direction to that of said material in each diffuser and in said receptacle, and means for regulating the level of said liquid in said last diffuser.

United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

	One Month ending March 31st.		Three Months ending March 31st.	
Unrefined Sugars.	1930. Tons.	1931. Tons.	1930. Tons.	1931. Tons.
Poland	1,084	31,003	6,516	35,188
Germany	3,820	14,657	3,820	18,932
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	....	....	508	....
Java	....	....	....	....
Philippine Islands	....	....	....	....
Cuba	19,571	4,790	68,393	22,195
Dutch Guiana	....	....	....	....
Hayti and San Domingo	31,031	9,251	41,237	12,684
Mexico	....	....	....	....
Peru	7,896	9,093	33,853	29,952
Brazil	9,697	....	32,510	1
Union of South Africa	38	4,004	13,267	34,727
Mauritius	15,605	9,391	71,072	54,368
Australia	17,126	5,070	69,865	75,506
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	9,451	15,808	18,063	29,882
Other Countries	2,003	18,744	13,791	29,446
Total Raw Sugars	**117,322**	**121,811**	**372,894**	**342,881**
Refined Sugars.				
Poland	....	77	....	287
Germany	4	74	72	225
Netherlands	1,391	570	2,890	1,401
Belgium	34	134	194	349
France	....	....	....	....
Czecho-Slovakia	1,226	2,134	3,399	5,955
Java	....	....	....	....
United States of America	533	796	2,086	2,069
Canada	....	1	....	2
Other Countries	....	1	8	25
Total Refined Sugars	**3,189**	**3,788**	**8,649**	**10,313**
Molasses { Foreign	60,769	14,987	101,722	39,745
Molasses { British	388	331	8,811	7,573
Total Imports	**181,668**	**140,917**	**492,076**	**400,512**

EXPORTS.

British Refined Sugars.	Tons.	Tons.	Tons.	Tons.
Denmark	43	78	138	167
Netherlands	....	....	....	....
Irish Free State	3,925	4,062	9,580	9,626
Channel Islands	287	119	634	356
British West Africa	62	106	448	344
Canada	....	....	....	....
Other Countries	16,737	3,831	33,829	22,165
	21,055	8,196	44,628	32,658
Foreign & Colonial Sugars.				
Refined and Candy	136	76	424	333
Unrefined	68	28	178	160
Various Mixed in Bond	....	....	....	....
Molasses	155	21	324	45
Total Exports	**21,414**	**8,321**	**45,554**	**33,196**

United States Atlantic Ports.

(*Willett & Gray*).

(Total of 2,240 lbs.)	1931 Tons.		1930 Tons.
Total Receipts, Jan. 1st to April 25th	831,514	..	742,907
Deliveries „ „ „	837,537	..	963,489
Meltings by Refiners „ „	762,435	..	929,425
Exports of Refined „ „	11,000	..	15,730
Importers' Stocks, April 25th	152,869	..	216,689
Total Stocks, „	313,747	..	410,347
	1930		1929
Total Consumption for twelve months	5,599,377	..	5,810,980

Cuba.

RECEIPTS, EXPORTS AND STOCK AT APRIL 25TH.

(*Willett & Gray*).

	1931 Tons.		1930 Tons.
Production to date	3,025,000	..	4,220,000
Less Cuban Consumption to date	42,000	..	26,568
	2,983,000	..	4,193,432
Stock at Shipping Ports	986,298	..	1,751,553
Total Exports	260,030	..	460,505
Total Receipts at Shipping Ports	1,246,328	..	2,212,058
Stock on Plantations and in transit to Ports	1,736,672	..	1,981,374

United Kingdom.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION OF FOREIGN SUGAR FOR THREE MONTHS ENDING MARCH 31ST, 1929, 1930, AND 1931.

Imports.	1929. Tons.	1930. Tons.	1931. Tons.
Refined	11,821	8,649	10,313
Raw	531,395	372,894	342,881
Molasses	69,537	110,533	47,318
	612,753	492,076	400,512

Exports (Foreign).	1929. Tons.	1930. Tons.	1931. Tons.
Refined	386	424	333
Raw	136	178	160
Molasses	2,566	324	45
	3,088	926	538

HOME CONSUMPTION OF IMPORTED SUGAR.

	1929. Tons.		1930. Tons.		1931. Tons.
Refined	11,006	..	8,989	..	12,024
*Refined (in Bond) in the United Kingdom	201	..	555	..	8
†Raw	452,527	..	399,862	..	377,508
Total of Sugar	463,735	..	409,406	..	389,541
Molasses	2,507	..	1,842	..	1,249
Molasses, manufactured (in Bond) in the United Kingdom	1	..	4	..	—
	466,243		411,252		390,790

STOCKS IN BOND IN THE CUSTOMS WAREHOUSES OR ENTERED TO BE WAREHOUSED AT MARCH 31ST.

	1929. Tons.		1930. Tons.		1931. Tons.
Manufactured from Home Grown Beet	37,450	..	55,100	..	70,200
Refined in Bond	8,750	..	1,750	..	250
Foreign Refined	12,300	..	9,000	..	4,550
„ Unrefined	248,600	..	314,950	..	218,200
	307,100		380,800		293,200

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty-paid sugar returned to refineries to be again refined. Sugar refineries ceased working in Bond as from 25th April, 1928.

† The quantities here shown include 148,154 tons entered for refining in refineries in the month ended 31st March, 1931, and 348,980 tons in the three months ended 31st March, 1931.

Sugar Market Report.

Our last report was dated April 10th, 1931.

During the period under review all markets have shown a declining tendency, especially in America, where, owing to the general financial depression, sellers have predominated, and prices have fallen nearly 20 points. The fall in Europe has not been so great.

Although it was the generally accepted opinion that the Chadbourne Plan would be ratified, unconfirmed rumours have been spread about to the contrary effect, which brought out more sellers and frightened buyers into their previous attitude of reserve. However, it is now a fact that the Chadbourne Plan has been ratified by all countries concerned at Brussels on Saturday May 9th.

The London Terminal Market has fallen about 9d. per cwt., but a recovery has taken place during the last few days, nearly 20,000 tons being tendered on May contracts, but this had little effect on the market. May fell from 6s. 6d. to 5s. 10½d. and recovered to 6s. 1½d., whilst August fell from 6s. 9¾d. to 6s. 0¼d. and recovered to 6s. 4d. December moved from 7s. 1d. to 7s. 2d. to 6s. 4½d. to 6s. 8d., whilst March moved from 7s. 4½d. to 6s. 7d. to 6s. 10½d. May has been traded in fairly extensively and fell from 7s. 6d. to 6s. 9½d. and recovered to 7s. 0½d. The latest prices are :—

MAY		AUGUST		DECEMBER		MARCH		MAY
6s. 1½d.	..	6s. 4d.	..	6s. 8d.	..	6s. 10½d.	..	7s. 0½d.

The trade in refined sugar has been very quiet throughout the whole month. Considerable purchases of sugar were made prior to the Budget, but as the Chancellor made no change in the sugar duties, these supplies will have to be absorbed before the trade can become really active again.

The Refiners made two reductions in their prices during the month ; 3d. per cwt. on April 28th and 3d. per cwt. on May 7th. The Home Grown factories made similar reductions. The latest prices are, Tates No. 1 Cubes 24s., London Granulated 20s. 7½d.

Business in Raws to the refiners has been quiet, but small quantities of 96 per cent. cane have been sold from 6s. 7½d. to 6s. c.i.f. and from time to time 88 per cent. beet has been sold at the same parity.

The American market has been influenced by sales of preferential sugar, Porto Rico and Philippines. Cuba on the whole has not been a seller but has remained aloof from the market.

The Refiners in the U.S. have not been heavy buyers and have only bought sugar at declining prices. The latest price c.i.f. New York is 1·14, as against 1·38 a month ago.

The Futures market has been depressed and has fallen in sympathy.

No further sales of Russian sugars have been reported.

F. O. Licht issued a second estimate of the European Beet sowings, excluding Russia, of 1,607,000 hectares against 1,905,861 hectares last year. This represents a decrease of 15·69 per cent. With regard to Russia, Licht does not alter his first estimate of an increase of 30 per cent.

21, Mincing Lane,
London, E.C.3.
11th May, 1931.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 390. JUNE, 1931. VOL. XXXIII.

Notes and Comments.

The Outlook.

With the signing of the Brussels agreement covering the Five-Year Sugar Plan on May 9th speculation as to the immediate course of events naturally subsided. Mr. CHADBOURNE returned to America, in which country as well as in Cuba his presence was doubtless advisable in order to consolidate his commitments. In Cuba there has been a feeling, encouraged by the general tone of pessimism, that Mr. CHADBOURNE has conceded too much to Java in the matter of the 2-cent price basis which starts the release of segregated sugars. This figure is considered too low for the average Cuban mill and as a consequence it is thought that Java's participation in the pact has been bought at a cost that will strike Cuba the most heavily. It is not possible to be dogmatic on this point without knowing the precise arguments that were advanced at the conferences which fixed the price basis; but the stakes of success or failure were heavy, and for the sugar world as a whole it was of prime importance that the pact should be completed and the only chance be taken to carry out a much needed scheme of restriction. That it has hit Cuba heavily need not be denied; it is more pertinent to enquire what would have happened if the conference had been a failure and the sugar market was faced with the continuation *sine die* of a vast surplus of sugar running into millions of tons. Doubtless the middlemen in Cuba would have continued business, doubtless also two or three hundred thousand agricultural workers in that island would have been able to continue nominally at work for a starvation wage; but the evil day would only have been put off and would have come later on with still more disastrous consequences. You cannot go on producing a staple crop at about 50 per cent. under cost price and remain solvent. Cuba's agricultural workers are being well advised to turn their hand to other crops also than the staple one of sugar, and if the process of conversion is painful the ultimate results appear to us the only ones that spell salvation for that community. Cuba will always remain a large sugar producer, but the world is developing ideas about Home or Empire sugar production which are inimical to the prospects of a future Cuban crop of five or six million tons of sugar. Much remains to be done in Cuba to put the sugar industry on a basis of low production costs, but this is not contingent on the restoration of Cuba to the

status of a one-crop island (leaving tobacco out of the argument). The path of any reformer in Cuba is a difficult one and the President, who seems to visualize the position accurately, is legislating on the edge of a volcano of popular discontent. Another sporadic outbreak of rebellion was reported in the papers last month but seems to have met with no more success than previous ones. It is to be hoped that Mr. CHADBOURNE, released from the long negotiations in Europe, will be as successful in smoothing matters in his American sphere of influence.

The market, led by New York, has refused so far to respond to the factors that result from the Brussels Agreement, though at the moment of writing it is showing some definite indications of getting "the jumps" and has registered an advance of 15 points within a few days. Still, it is becoming clear that the improvement is going to be a more gradual one than was originally counted on. There is no shortage of sugar at the moment, the segregated sugar at least exists, consumption has not been helped by the world-wide depression in trade which has cut down the earning power of the masses; and there is a powerful bearish element in the market that throws all its influence against price improvement. But if the immediate outlook is somewhat obscure, the more distant one is governed by definite factors that cannot be ignored in the end. The reduction in the European crop (the actual extent of which will not be known till some idea is available of how it averages in the matter of yield); the smaller Cuban and Javan crops foreshadowed; the fact that if the quotas of this year are not fully exported for lack of demand they cannot be carried over into next year but must be eliminated by reducing next year's crop—these factors will all tend within the next twelve months to produce a healthier market. In particular, it will be no longer the case that the American market will be hampered, at the commencement of 1932, by the existence of a Cuban surplus waiting to be dumped on it at bargain prices. If Cuba does not succeed in selling the whole of its 1931 U.S. quota, the surplus will be written off, so far as availability for the market is concerned.

The Position in America.

In New York, sugar market prices have recently fallen to a level that has not been touched since the beginning of October last year. Amongst the explanations offered for this decline is the uncertainty as to what will happen politically in Cuba (the "bears" seem to be always counting on a revolution occurring and wiping out all the Chadbourne-Machado restrictions) and to doubts with regard to the sugar consumption this year in the States. Meltings and deliveries during the first four months of 1931 compare unfavourably with those of the like period in 1930, but that is in part explainable on the assumption that during the first five months of 1930 large quantities of refined sugar were stored away with the idea of taking advantage of the new tariff. This addition to invisibles may or may not have been disposed of by now; but the economic outlook in the United States for the time being rather militates against hopes for an early revival in the upward trend of consumption. America is suffering from the reaction following several boom years that were bolstered up by the intensive cultivation of instalment buying (to quote a letter contributed to the *Times*). This form of buying induced a large proportion of the population to mortgage their future earning powers and thereby stimulated a mad speculation in industrial securities, thus bringing about a condition in which the current expenditure of the purchasers is enormously lessened. In addition the trade slump following the boom years has resulted

in a great decrease in export sales, thereby affecting the receipts of the wage-earners. For all these reasons, it would not be surprising if the American consumption of sugar during 1931 suffered a further if temporary decline, as compared with 1930 and 1929.

Other Factors.

The absence of Peru and Santo Domingo from participation in the Brussels Convention has been urged as a bear point. Nothing is known as yet as to their ultimate likelihood to join. But Peru at any rate is no immediate factor of danger to the pact, since the prolonged drought covering the first four months of this year is now said to have caused so much damage to the canefields that production both this year and next promises to be much lower than was originally estimated. Hence exports this year will be much below those of previous years. CZARNIKOW quotes a report that the producers in Formosa have arrived at an agreement to restrict the 1933 production by 30 per cent. LICHT's estimate of the European beet crop, published May 30th, makes no alterations in the previous estimate of a 15·9 per cent. decrease without Russia. As for Russia, he remarks that there is nothing fresh to report. Taken altogether, crop limitation or reduction seems to be the order of the day over a wide area—the natural consequence, after all, of a prolonged uneconomic price.

Dr. C. A. Barber awarded an Indian Research Prize.

The late Sir GANGA RAM, who was a well known philanthropist in the Punjab, inaugurated a Prize (to be known as the Maynard Ganga Ram Prize) of Rs. 3000 to be awarded every three years "for a discovery or an invention or a new practical method which will tend to increase agricultural production in the Punjab on a paying basis," or, briefly, to the person who made within the period the greatest discovery in the field of agriculture. The first award has just been made, and the committee charged with the task of bestowing the prize have selected as the first recipient Dr. C. A. BARBER, C.I.E., on the grounds of his work on sugar cane which, while originating at Coimbatore in Madras, have had a far reaching influence on sugar cane culture all over India.

In the opinion of some of those in India best fitted to judge, the discovery made by Dr. BARBER with regard to the fertility of cane seed has been by far the greatest discovery made by any agricultural officer in India up-to-date, having opened up a vista of great possibilities for the development of the sugar industry in India. It has already added many lakhs of rupees to the profits of cane growers in that country and has simultaneously increased materially the profits of sugar factories in Bihar, where a large area is now cropped every year with Coimbatore canes. There would appear to be no limit to the extent to which this discovery may in the long run benefit the grower of cane and the manufacturer of sugar, for the area under improved varieties is increasing year by year; while the initial discovery of these varieties has led to others being evolved which will almost certainly surpass in yield that of the earlier Co types, of which Nos. 200 to 216 were released for North India under BARBER's régime at Coimbatore.

Three opinions by Indian authorities on the merit of Dr. BARBER's work may justifiably be given in confirmation of the above general view. Sir JAMES MACKENNA, for many years Agricultural Adviser to the Government of India, in the course of a lecture before the Royal Society of Arts[1]

[1] See *I.S.J.*, 1929, 15.

declared that it was impossible to over-estimate the value of the work done by BARBER for the sugar industry in India during his appointment, and it was safe to say that if his work was continued along the lines laid down by him, and under competent supervision, the thin cane problem of India would be solved. Then Mr. NOËL DEERR, author of the principal text-book on the cane sugar industry, and more recently a close student of Indian sugar affairs, wrote not long since in the *Agricultural Journal of India*:[1] "BARBER started his breeding work using *Saccharum spontaneum* as a parent, and although Chunnee, itself a hybrid with Saccharum as a parent, had been very early used, and Kassoer had been used later (in Java), it was not till BARBER's work had started that the parentage of these canes was visualized. It is therefore to BARBER, I think, that the credit of introducing *Saccharum spontaneum* blood into strains of cane intended for extensive planting should be given." Finally Sir FRANK NOYCE, Chairman of the Sugar Committee whose Report was issued in 1920 wrote that it was the soundness of BARBER's botanical investigations at Coimbatore that "has enabled us to recommend a forward policy of expansion in cane breeding work."

In view of the fact that Dr. BARBER left India more than a decade before this prize came to be awarded and that his particular work, cane breeding, did not seem to be directly envisaged in Sir Ganga Ram's scheme, it would not have been surprising if the Committee appointed to manage the prize fund had decided that he was not eligible. It is therefore to their credit that they recognized the special merit of his work and in particular the length of time that it has required (in the very nature of its operation) to bear fruit ; it is only the last few years that have witnessed the full harvest of results originating from a discovery of ten or more years ago. We hasten to congratulate Dr. BARBER on this signal recognition of his pioneer work for Indian agriculture, and one, moreover, that promises to have ramifications in other sugar growing regions to which Co canes are gradually penetrating.

The Recent Cyclone in Mauritius.

From Mr. P. DE SORNAY we have received a detailed account of the effects on the sugar crop of Mauritius of the disastrous cyclone which swept the island at the beginning of March last. This is too long for reproduction, but we give here the gist of his remarks.

This cyclone proved the worst experienced so far this century, exceeding in violence the visitations of 1902, 1908, and 1926 For 72 hours the wind blew with a velocity varying between 50 and 85 miles an hour, the canes being subjected to winds that veered in all directions and hence the percentage of broken canes was higher All the canes had their leaves torn, while the plant canes, due to be cut in August, were mostly blown down or broken. The advanced ratoons suffered less severely, and in some cases had only their leaves lacerated by the wind. In any event the loss of the leaves was a severe setback to the development of the plants, while the weather following on the cyclone was unfortunately not conducive to allowing the canes to make a quick recovery in their leaf production. On the top of this, the cyclone arrived within measurable distance of the period (end of April and onwards) when the cool season sets in and cane growth practically ceases.

Mauritius has averaged over the last ten crops some 227,000 tons of sugar yearly, as against a normal of 235,000 tons. This year a bumper crop of 250,000 tons was hoped for, providing the climatic conditions from March to

---

1 *I.S.J.*, 1931, 8.

August should prove ideal. In any event, a crop of 235,000 tons might reasonably have been expected. As it is, Mr. DE SORNAY estimates the crop reduction at 20 per cent. (i.e., 47,000 tons), given normal weather for the rest of the year. But apart from the loss of cane, the deterioration of the remaining cane stalks in respect of sugar in cane and juice purity is not negligible, and is an invariable accompaniment of such cyclonic disturbances. Judged from the experience of other cyclone years, the factory loss may be anything between 5·5 and 6·5 per cent. of the initial estimate, that is a reduction of 12 to 15,000 tons of sugar, thus bringing the total loss in field and factory to about 60,000 tons of sugar, which figure reduces the crop to be expected to at least 175,000 tons. It is most unfortunate that Mauritius in addition to the troubles occasioned by uneconomic prices should have been once more a victim of these occasional ravages of nature. One notes that there were two cyclones within about 5 years of one another in the first decade of the century and then an interval of nearly twenty years. The two cyclones of 1926 and 1931 are about the same period apart ; will it prove the case that another long interval of immunity is to be experienced ? This, though, is a point for the meteorologists to settle.

The Indian Sugar Season, 1930-31.

Unofficial figures to hand from India suggest that the 1930-31 sugar season has been a satisfactory one. The data are necessarily only approximate, but when the official figures are published (possibly a year hence) we do not anticipate that they will differ materially from those now calculated.

In all factories in India some 1,350,000 short tons of cane have been crushed, of which amount about 90 per cent. was treated in factories in Upper India. The sugar content of the cane was a little above the average, being about 11·8 per cent., and the yield over all India was probably a little over 9 per cent., whence about 120,000 tons of sugar was produced. The highest yield recorded in Upper India has been 9·85 per cent. obtained by two factories; this has only been exceeded by one factory in Bombay and one in Burma, the former obtaining about 11 per cent. from irrigated noble cane.

The biggest factories—four in number—crushed each about 90,000 tons of cane, dwindling down to about 10,000 tons in the smallest. The increased amount is due to the low prices for gur. Plantings of cane are largely increased this year, owing to the fall in the price of grain, chillies, tobacco, etc., the principal competing money crops, as opposed to rice, dhal, etc., which are food crops. There has been a progressive rise in efficiency, though too many factories are reported to be still working with a view to capacity only and neglect extraction. Generally speaking, Indian sugar factories are now well equipped, but operation still leaves room for improvement. Some of them, however, on both equipment and operation sides would probably rank high anywhere. It is reported that at least four new factories are contemplated, and doubtless the existence of the new sugar tariff will clinch the matter in putting them into being.

B. J. OWEN.—Sentence of 4 years' penal servitude was passed at the Old Bailey, London, on Brynar James Owen, for obtaining by fraud £30,000 from the International Harvester Co. (Great Britain), Ltd. and £35,000 from the Ford Motor Co., Ltd. He had previously held the post of Director of the Institute of Agricultural Engineering, Oxford, and had evolved the method of dehydrating sugar beet, known as the "Oxford process," which has been subjected to a good deal of criticism. The judge described the offence as an extensive, well-thought-out and ingenious fraud.

The New Sugar Research Station in Mauritius.

First Annual Report for the Year 1930.

This Station " was formed with the object of attacking the more pressing problems connected with the genetics, physiology and bio-chemistry of the sugar cane in Mauritius, the most urgent problem in hand being the search for a new cane variety to replace the Big Tanna which is failing after a period of 30 years' supremacy in the island—the average yield of cane per acre for the whole island in 1929 was only 18·05 tons."

The new establishment, with a substantial subvention for five years from the Empire Marketing Board, provides for a Senior Geneticist (in charge of the station), a Bio-chemist and a Research Botanist, each with a Scientific Assistant, while the Cane breeding officer of the Department of Agriculture has been attached to the station for work under the Geneticist. All of these officers have been appointed, with the exception of the Research Botanist, and commenced work in January, 1930, when the station was opened. This first Report gives details of the work completed during the year 1930, the general introduction and account of the cane breeding work having been written by A. G. G. Hill, the Geneticist, and the bio-chemical portion by N. Craig, the Bio-chemist.

The Geneticist, however, spent four months (February to May) in Java during the arrowing season there, and from October the 1st till the end of the year also performed the duties of Acting Director of Agriculture ; while the Bio-chemist took charge of the station during the visit to Java, and remained at the crossing work till August because of the non-arrival of his chemical apparatus. It is rather remarkable, in these circumstances, that such satisfactory progress in crossing work should have been made ; but, as will be seen, the new work in 1930 has been cleverly " spliced " on to the old so as to form a continuous whole.

A very brief summary is given of previous cane breeding work in Mauritius, commencing with the early observation in 1871 by Lemerle of " cane seedlings still attached to the parent plant." Seedlings were obtained from fuzz received from Barbados in 1890, and from Mauritius canes in the following year. Perromat next took up the work and over half a million seedlings were raised by him during 1893-1894. Some of these seedlings may still be found locally, as 55P, 131P and 33P, but the subject was overshadowed by " the enthusiasm for White Tanna cane." Boname, coming from Guadeloupe, systematized the cane breeding work in 1893 and planted out 1214 seedlings between 1895 and 1908 ; but again the success of White Tanna eclipsed his work and only No. 1900 remains. Lastly, since 1913, cane breeding has been regularly carried out in Mauritius, approximately 1000 seedlings being planted out each year ; and 221 of these "M" seedlings were handed over on the arrival of the Geneticist. Table I enumerates the numbers and parentage (usually uncontrolled) of the seedlings raised each year from 1916 to 1928. The fact is noted that only six of these seedlings had Tanna parents, because of the sterility of male and female organs, and even these six have since been discarded. Besides these 221 M seedlings, some 6000 raised in 1929 were handed over to the new station, details of which are given in Table II.

As to the cane breeding work accomplished during the year, although many details are given in the Report, no great degree of certainty can have been reached, and only some of the general outlines will be referred to here. As very little information was available on the flowering habits of the varieties

used for crossing, the work in the flowering season was concentrated on this subject and on making "suitable crosses to obtain information as to parent types and modes of inheritance." Table I shows that, between 1916 and 1928 three-quarters of the seedlings were derived from 55P, D 109 and D 74, "and as all of these are male fertile it appears probable that a large proportion of the seedlings raised were selfs." Two main lines of work were decided on : crosses between noble canes, and between these and those of Uba type and *Saccharum spontaneum*. The crossing was carried out at two stations, around Reduit (1000 to 1500 feet in elevation) and at Pamplemousses (200 ft.), with real differences in climate ; half arrows were used, so that the same arrow was sown at both stations. Fewer seedlings were obtained at the lower station but their growth was materially quicker. Incidentally, half arrows of six crosses were brought from Java in desiccators and sown at Pamplemousses 12 weeks after leaving Java, with the somewhat surprising result that 1654 seedlings were obtained as against only 323 in Java itself.

Since White Tanna introduced to Hawaii had been found to produce seedlings, on the chance that its character was altering in this respect 526 arrows were sown, and four seedlings were obtained, which four it is proposed to try and utilize as parents. Various methods of crossing were tried, with the result that the open crossing of Java is preferred, with the modifications that the male arrows are placed in 0·3 per cent. SO_2 solution, and a wooden wind shield is added because of the violent winds during the flowering season. Among various other observations and experiments described, the pollen examination appears to be of special interest, and the conclusions are thus summarized : The percentage germination figure of any variety has no absolute value owing to variability due to time and place : all flowers with red anthers (with one exception) give large amounts of viable pollen, and all flowers with yellow pollen give none : certain varieties (131P, 55P and RP6) produce red and yellow anthers, occasionally on the same arrow ; using the percentage of open anthers as a measure of the quantity of pollen produced, no significant correlation could be found between quantity and quality as determined by the sucrose test : a significant correlation was found between quality of the pollen as measured by the iodine test and the quality as determined by the sucrose test : direct sunlight has a lethal effect on pollen : cut arrows kept in SO_2 solution are not inhibited as regards pollen shedding or germination until after 5 to 7 days' immersion, when only yellow anthers are usually produced and the inflorescence loses its male characteristics. Table IV gives a complete account of the programme of cane breeding completed during the year—the parents used, the number of seedlings obtained and the number of these potted out.

These seedlings are classified as follows : Crosses between "noble" canes : Inter-specific crosses (*a*) first nobilized Glagah (*b*) fourth nobilized Glagah (*c*) Chunnee crosses (*d*) *Saccharum sinense* crosses (*e*) other combinations : Crosses made in Java : Selfings : Uncontrolled pollinations. The total numbers were 981½ arrows sown, 52,840 seedlings obtained, and about 20,000 seedlings potted up, half at Reduit and half at Pamplemousses.

In spite of the various interruptions recounted above, considerable progress was also made in the Bio-chemical section. Interesting results were obtained in the use of the refractometer in the selection of cane seedlings, in methods of sampling plots of sugar cane, in the use of cane measurements for the estimation of cane yields in manurial experiments, as regards estimation of phosphoric acid in cane juice for the detection of soil deficiencies, and the petrol-

ogy of Mauritius rocks, while studies have been commenced in soil fertility. In the circumstances, however, it will perhaps be advisable to defer giving details of this work until the Bio-chemist has had more time to get his section into proper working order.

C. A. B.

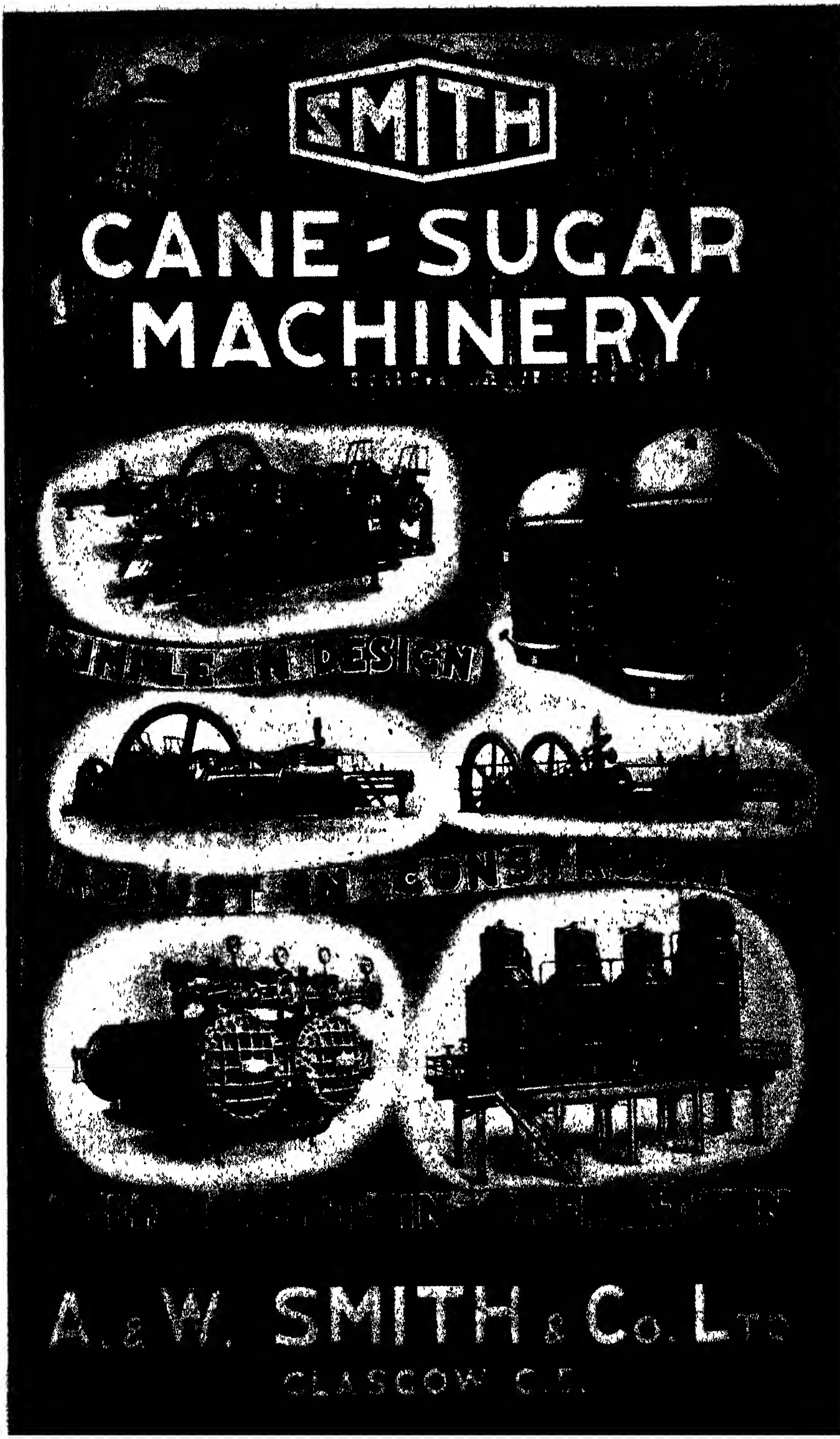
The Sugar Industry in Egypt.

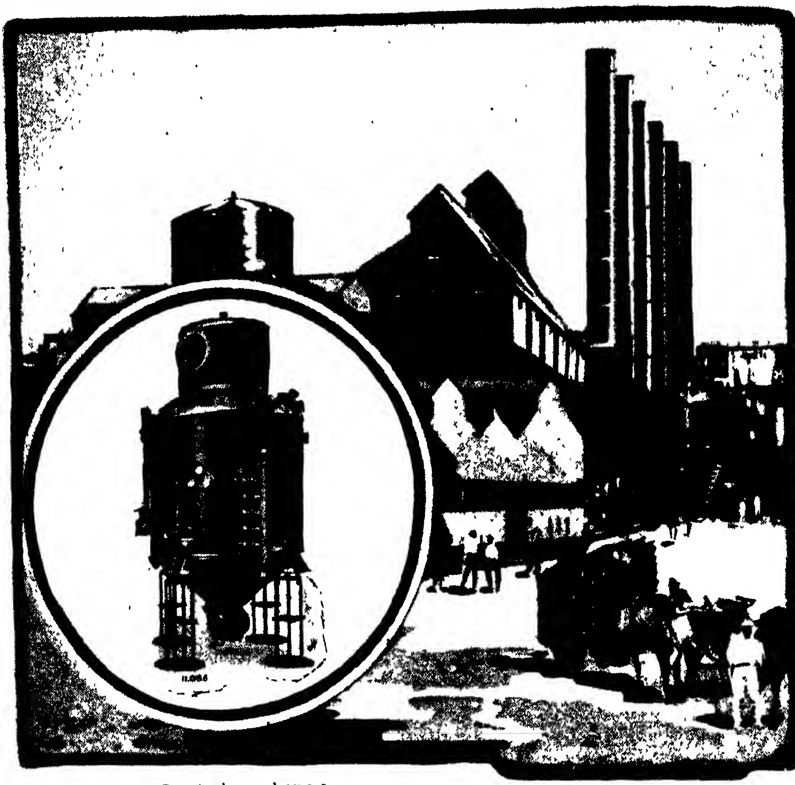
We have received, through the International Society of Sugar Cane Technologists, a paper in manuscript on the Egyptian Sugar Industry, by M. A. EL. KELANEY, the Junior Botanist to the Egyptian Ministry of Agriculture. As this paper is too long for publication, but contains a good deal of interesting matter, we have freely selected details from it for the present article.

The sugar cane is not indigenous in Egypt, and there is not a single trace or historical reference to its presence in the country in the Old Egyptian era. It was probably introduced from the east by the Arabs when they invaded Egypt (about 641 A.D.); but it did not become of importance as a crop, till the time of Mohamed Ali Pasha (1805), the founder of the present dynasty, dwindling again on the introduction of cotton. In 1850 ISMAIL PASHA restored the industry, establishing crushing mills and refinery under Government control; the canes were grown on the States Domains, which were the private property of the Khedive. Since that time the industry has gradually increased in importance, till it has become the second crop to cotton, and the first in Upper Egypt. In 1898 the Government sold its factories and monopoly rights to the present Sugar Company, the Société Général des Sucreries et de la Raffinerie d'Egypt. This Company owns about 3000 acres of land and also rents land from neighbouring farmers to grow cane, besides entering into contracts for cane at a fixed price of 3 to 4 P.T. (7d. to 10d.) per kantar (100 lbs.).

The average area under sugar cane is about 55,000 acres, of which some 12,000 are used for crushing in native mills and making syrup, and 10,000 grow canes for eating as fruit: thus there are 33,000 acres under canes to serve for the Company factories. The average yield per acre is about 3 tons of sugar, and hence the total output of sugar is about 100,000 tons. The average annual consumption varies from 150,000 to 160,000 tons; and, therefore, the additional area under cane, required for the industry to be self-sufficing, would be about 17,000. The local price paid for sugar made in the country varied, during the five years from 1924 to 1928, from £24 to £17 per ton, that for imported sugar being substantially less (no details are given as to any import duty). The average cost of growing sugar cane per acre (including about £12. 10s. 0d. for rent of land) is given as £24 for plant canes and £19 for ratoons.

The sugar cane is cultivated throughout Egypt, but the growing of cane for sugar making is confined to Upper Egypt, say, between latitudes 24° and 28°N. In Middle and Lower Egypt the cane is grown for making syrups by indigenous methods and for eating as a fruit. The factories are thus located in what is practically desert country, where rains occur occasionally but sometimes there is none for several years. Cane growing is therefore entirely dependent on irrigation from the Nile. The cane soils lie in narrow strips on either side of the river, and are alluvial deposits of great depth with underlying sand and chalk; and this alluvial deposit is to some extent renewed each year by the overflow of the Nile when in flood.


SMITH
CANE - SUGAR
MACHINERY
DESIGN
A. & W. SMITH & Co. Ltd
GLASGOW C.5.



The Inset above shows a
VACUUM PAN—COIL TYPE

As to the character of the soil, which is usually described as a heavy clay, various figures are quoted from PELLET and RACHE, and the following have been extracted or calculated from these. These authors remark that the soil is very uniform in its general composition and draw special attention to their high magnesium content. From an analysis of 26 sugar soils, the following percentages have been calculated : sand 37·5, clay 30, chalk 5, alumina and iron 9, and humus 1 ; and as to plant foods, phosphoric acid 0·15, potash 0·19, lime 2·05, magnesia 2·20, organic nitrogen 0·06.

Preparation of the land.—The soil is ploughed after the winter cereal or legume crop, and is left until the planting season, or sometimes watered at high flood and re-ploughed to a depth of 30 to 35 cm. It is later divided into furrows from north to south, the distance between the furrows being 80 to 90 cm. After this, the field is divided by canals, sub-canals, and ridges. The side canals, branching from the main irrigation ditch, are 100 metres apart, and the sub-canals, at right angles to them, are 21 metres apart, thus dividing the field into half-acre beds, which are further divided by mid-way ridges, leaving the furrows 10·5 metres long.

Planting date.—The best date for planting lies between February 15th and March 15th. Earlier planting causes delay in germinating, while later planting affects the quantity and quality of the crop and retards the date of harvest. The following figures give the rate of germination, when sets are planted on different dates : 15th January germinating after 35 days, 31st January 30 days, 15th February 25 days, 15th March 15 days, 31st March 10-12 days. Some lands rented by the Sugar Company are planted in September and October, known as autumn sowing, and give the cane a longer period of growth (15-16 months) ; they have the further advantages of early maturity, higher percentage of sugar, cheap labour during September and October, and the distribution of the field work during the year. The farmers generally, however, prefer to sow a catch crop during this period and postpone the cane planting till February.

The variety of cane grown.—POJ 105 is the only cane grown industrially on a large scale. Some details are given as to the introduction of cane varieties into Egypt during the present century, but the descriptions and analyses of these leave a good deal to be desired in various directions. Summarizing, there appear to have been three periods of activity in this respect. In 1903 the Director of the Sugar Company went on a world tour and brought back 128 cane varieties from the chief cane growing countries. Of these POJ 105 was considered to be the best, while POJ 826, 920, 979 gave promising yields : a Table follows, giving details of POJ 2725, POJ 2727, H 109, POJ 979, POJ 920 (suggesting that these varieties belong to this first introduction, which of course cannot be correct). In 1925 the Ministry of Agriculture imported ten Cuban varieties : five cuttings survived, each of one variety ; but the labels were undecipherable and they were given the numbers Giza 4, 7, 8, 9, 10. In 1927, lastly, the Ministry imported a number of cane cuttings which are now under trial, the most promising being Co 281, POJ 234 and POJ 36 M. The author of the paper appears to be confused as to mosaic which he indifferently calls by that name and streak. None of the last three were found to be attacked by "streak or mosaic."

Seed cane and planting.—The tops of plant canes are preferred as a source of seed cane, but the farmers usually cut up the whole cane, the average quantity required for an acre being 80 kantars, the canes being cut into three

or four pieces. There appear to be two methods of planting, which are called the dry and the wet, according to the state of the soil when the seed is sown.

(1) " After smoothing the ridges the cane cuttings are placed end to end at the base of the furrow and covered with soil 7 to 8 cm. deep from the opposite ridge, and irrigation follows. This is called the dry method."

(2) The cuttings are placed in pairs on the ridges without smoothing. Heavy watering follows, and the sets are pushed by the foot into the wet soil on the south side of the ridge. It is claimed that this method is less expensive and saves 30 to 50 per cent. ; it is also quicker in germination and it is easier to check the area sown, but cane thus planted is liable to lodge.

Manuring.— The Nile water brings down a certain quantity of plant food and the field rotations followed reduce the necessity for the heavy dressings used elsewhere. Small farmers use the remains of fallen old earthen buildings. which contain a very small quantity of nitrates and often a high proportion of salt ; others use dung manures. But sodium nitrate is the main source of readily available nitrogen. It is applied twice or three times, the first application being three months after planting, when the canes are 50 to 60 cm. in height, and the second a month later. From 200 to 300 kg. of nitrate are applied to the acre.

Irrigation and after-cultivation.—The Nile is the source of water, and the cane is irrigated as soon as it is planted, followed by periodical waterings every ten or twelve days for 3 and 4 months. Then, irrigation is done every 14 days till the flood period, when the interval between irrigations is reduced to 10 days until the 20th of October. After that date watering is done two or three times, and is stopped a month before cutting commences. The fields are kept clean from weeds by periodical hoeings with the *fass*. Plant canes are hoed three times after every irrigation, and each time part of the soil is drawn over from the opposite ridge, till the cane row is ultimately in the middle of the ridge.

Growth and maturing.—Cane shoots appear at from 25 to 30 days after planting, and by the end of June they reach a length of 40-50 cm. Afterwards the rate of growth averages from 3 to 4 cm. daily, reaching a height of 3·20 to 3·50 metres in November. The canes mature in 10 to 12 months, about the end of December in ratoons and about the 15th of January in plant canes.

Yield of canes.—A Table gives this for POJ 105 for the ten years between 1917 and 1927. Dividing the Table into two five-year periods, in the first five-year period the average annual yield of cane was 581 kantars (per acre), and in the second 928 kantars. The figures for 1st ratoons were 485 and 729, and for 2nd ratoons 333 and 571. No remarks are made as to this increase in yield, but presumably it is owing to increasing attention being paid to the crop. Further figures compare the Company's yields with those of the farmers. The Company obtains for plant canes and first ratoons 1000 to 1200 k. and 900 to 1000 k. respectively, while the figures for the farmers' crops are given as 700 to 900, and 600 to 700 k. It may therefore be presumed that the Company is paying marked attention to the fields under its control, and this is being followed by the farmers. Although the averages for 2nd ratoons are given, the remark is made that cane is usually left only for two years on the same land.

But from the section on " Investigation " it is obvious that there is a good deal of work to be done in the cane field. Cane breeding and selection in Egypt are stated to be " not an easy matter, for the cane never yields seed." Although it would probably be possible to get over this difficulty, it is very

doubtful if it would be at all desirable to introduce cane breeding at present; and this opens up the matter of introduction of varieties from other countries. At present Egypt appears to be only subject to a moth borer (*Chilo simplex*) and the mealy bug (*Pseudococcus Sacchari*) among insects, and "streak and mosaic" among diseases. And this makes it peculiarly necessary that proper quarantine arrangements should be made to keep out other pests and diseases —in spite of the suggestion that "the dry hot climate prevents the streak and mosaic from spreading." The mealy bug, which is probably the main enemy, can probably be easily overcome as a serious pest; but it may be worth while to study it in connexion with the high magnesia content in the soil.

Since this paper of EL. KELANEY'S was written, a new chapter has opened in the history of the sugar industry in Egypt, in that the Government and the Sugar Company have come to an agreement to shut out foreign sugar altogether, and make Egypt self-sufficing in this respect. The Government proposes to establish a Sugar Régie or revenue department with sole control of sugar in Egypt. By the terms of agreement, the Company is to increase production so that the needs of the country may be satisfied, and this only by growing more cane in the country itself, with the proviso that under certain limitations (until the increased production is reached?) it may import sugar. If the Company fails in this, Government may step in. If, on the other hand, the Company produces an excess, export of this excess will be assisted by the Government.

An Advisory Council is to be appointed which will advise the Government on the price at which sugar should be sold in the country each year, and any other matters which may arise. On this Council the Sugar Company will be represented, while the Government will appoint two members to the Administrative Board of the Sugar Company. The agreement is made in the first instance for fifteen years; but after five years it may be terminated by either party on three months' notice.

C.A.B.

The Java 1931-32 Crop.

Effect of Reduced Plantings.

News to hand from Java from a reliable source indicates that the plantings for 1932 are being sufficiently restricted to reduce the 1931-32 crop[1] to 2,600,000 metric tons *telquel*.

On this basis we figure out the following :—

	Metric Tons.
Stock to be expected at 31st March, 1932	770,000
Crop of 1932	2,600,000
Total disposable	3,370,000
Local Consumption (April-March) say	500,000
Disposable for Export	2,870,000
Exportable Allowance (2,200,000+100,000+100,000)	2,400,000
Stock to be expected at 31st March, 1933	470,000

[1] That is, the crop planted April-July, 1931, and harvested April-October, 1932.

The 1930 Java Sugar Crop.

By R. J. PRINSEN GEERLIGS.

During 1930, 179 factories were active in Java. The sugar estates planted and harvested an area of 198,642 hectares (489,645 acres) against 197,085 hectares (486,799 acres) in 1929. The total amount of cane harvested was 25,292,273 tons[1] or 51·54 tons to the acre. The total sugar crop amounted to 2,869,946 tons, calculated as crystals[2] or 13,121 lbs. to the acre. The figures for the different groups, totals and averages in tons, lbs., acres, etc., as given below, are calculated after the statistics compiled by Mr. A. VAN LEER in the "Mededeelingen van het Proefstation voor de Java Suikerindustrie," 1931, No. 3.[3]

The 1930 crop was a little less than that of the year before ; it had an average production of sugar to the acre of 13,121 lbs. against 13,205 lbs. in 1929. The monthly estimates of the production of the mills associated with the United Java Sugar Producers were as follows :—

Date	Estimates. Tons.	Date.	Estimates. Tons.
March 21st	2,478,000	August 6th	2,606,000
May 7th	2,478,000	September 8th	2,634,000
June 11th	2,505,000	October 9th	2,651,000
July 9th........	2,551,000	November 7th	2,658,000
		Final result	2,660,390

In 1930 the average tonnage of cane amounted to 51·54 tons to the acre. The group of Sidhoardjo reported the largest figure (57·59 tons), followed by that of Djombang (57·47 tons), while that of Cheribon was lowest in this respect, with only 46·19 tons of cane to the acre.

The sugar content of the cane was not so high as in the year before, so that the average sugar extraction was 11·36 ; the highest was attained in the group of Sidhoardjo with 12·59 and the lowest in that of Banjoemas with 9·54 per cent.

The highest average yield of sugar to the acre is reported from the group of Sidhoardjo with 16,237 and the lowest in the group of Banjoemas with 11,509 lbs. The maximum figure for one single factory was obtained in the group of Djocja, where Gondang Lipoero estate scored the greatest output of sugar to the acre with 18,762 lbs.

In studying the list of cane varieties planted, it will be seen that practically the whole planted area is covered with POJ canes (97 per cent.).

The sugar crop amounted to 2,869,943 tons, calculated as crystal ; of this amount 2,816,005 tons were first sugars, while the balance consisted of after-products. Besides the sugar, a quantity of 33,198 tons of solidified molasses and one of 827,287 tons of liquid molasses were manufactured.

Table IV shows an increase both in the first running white plantation sugar and the refining crystals of 98° polarization ; the other assortments were of minor importance.

In Table VI we give the results attained in factory work during the last decade of the 1930 campaign, and as a comparison also those of some previous years.

We also give below the data relating to the total sales of Java sugars and the portion sold by the United Java Sugar Producers, which body,

[1] Tons of 2240 lbs.

[2] The crystal factor is as follows : Superior head sugar, 99·40 ; superior soft sugar, 97·51 ; head-sugar, 97·15 ; muscovado, 95·45 ; molasses sugar 8-10, 80·00 ; molasses sugar 11-12 ; 85·00 ; bag sugar, 75·00.

[3] Archief voor de Suikerindustrie in Ned Indie, Deel III.

The 1930 Java Sugar Crop.

I.—Cane Crop.

Groups and Totals.	Number of Factories.	Land under Cane Hectares.	Land under Cane Acres.	Cane Harvested Tons.	Cane Harvested Tons per Acre.	K.G. per Hectare.
Sitoebondo	12	15,134	37,380	2,042,011	54·40	136,600
Probolinggo	12	15,012	37,079	1,894,330	50·82	127,600
Pasoeroean	15	12,154	30,020	1,462,598	48·55	121,900
Sidhoardjo	13	9,992	24,680	1,413,584	57·59	144,600
Modjokerto	11	9,540	23,563	1,200,087	50·46	126,700
Djombang	11	9,474	23,400	1,347,976	57·47	144,300
Kediri	12	18,004	44,470	2,125,429	47·87	120,200
Ngandjoek-Madioen	15	17,982	44,415	2,422,999	54·56	137,000
Solo	15	20,149	49,768	2,493,986	49·54	124,400
Djocja	17	17,303	42,738	2,193,248	51·30	128,800
Banjoemas	7	12,048	29,758	1,602,160	53·85	135,200
Koedoes	11	11,085	27,380	1,413,654	51·62	129,600
Pekalongan	7	8,697	21,481	1,073,444	50·78	127,500
Tegal	10	9,642	23,815	1,212,512	50·90	127,800
Cheribon	11	12,161	30,037	1,394,285	46·19	116,000
Total 1930	**179**	**198,377**	**489,984**	**25,292,273**	**51·54**	**129,400**
„ 1929	179	197,085	486,799	24,140,899	49·59	124,500
„ 1928	178	195,086	481,863	25,295,079	52·53	131,900
„ 1927	178	184,462	455,806	21,113,044	46·04	115,600
„ 1926	178	179,702	444,038	18,683,145	42·08	105,660
„ 1925	179	178,290	439,695	19,023,897	43·19	108,446
„ 1924	179	172,311	424,945	18,029,702	42·36	106,357
„ 1923	179	162,481	401,485	16,078,051	40·04	99,986
„ 1922	182	160,908	397,443	16,759,106	42·05	105,816
„ 1921	183	159,474	394,060	14,939,679	37·89	95,125

II.—Sugar Extracted.

Groups and Totals.	Kg. per Hectare.	Lbs. per Acre.	On 100 Cane.	Yearly maximum output of any single factory. Kg. per Hectare.	Lbs. per Acre
Sitoebondo	14,100	12,577	10·32	19,709	17,586
Probolinggo	13,300	11,863	10·42	16,094	14,365
Pasoeroean	14,600	13,026	11·98	17,400	15,529
Sidhoardjo	18,200	16,237	12·59	20,800	18,558
Modjokerto	14,900	13,294	11·76	17,300	15,433
Djombang	16,600	14,808	11·50	18,228	16,264
Kediri	13,600	12,131	11·31	18,786	16,761
Ngandjoek-Madioen	15,900	14,183	11·61	17,860	15,935
Solo	14,100	12,577	11·33	17,100	15,256
Djocja	14,800	13,205	11·49	21,030	18,762
Banjoemas	12,900	11,509	9·54	14,995	13,379
Koedoes	14,900	13,294	11·50	18,420	16,434
Pekalongan	14,800	13,205	11·61	17,000	15,164
Tegal	14,900	13,294	11·66	17,180	15,326
Cheribon	14,500	12,936	12·50	16,570	14,784
Average 1930	**14,700**	**13,110**	**11·36**	**21,030**	**18,762**
„ 1929	14,800	13,205	11·82	21,431	19,120
„ 1928	15,100	13,433	11·45	22,010	19,635
„ 1927	12,800	11,413	11·09	20,416	18,247
„ 1926	10,966	9,782	10·38	18,581	16,578
„ 1925	12,881	11,491	11·88	19,399	17,308
„ 1924	11,582	10,326	10·88	18,015	16,097
„ 1923	10,965	9,784	10·97	16,362	14,480
„ 1922	11,226	9,950	10·61	16,362	14,480
„ 1921	10,517	9,321	11·04	17,911	15,875

III.—SUGAR PRODUCTION IN TONS.

Groups and Totals.	First Sugars	After Products.	Total Product as crystal.	Molasses. Solidified	Molasses. Liquid.
Sitoebondo	211,568	2,544	210,083	6,504	69,017
Probolinggo	185,586	19,141	197,437	—	64,986
Pasoeroean	154,444	29,240	175,376	—	47,930
Sidhoardjo	178,129	2,918	177,617	6,943	37,266
Modjokerto	141,587	1,495	141,515	—	40,455
Djombang	152,294	6,075	155,227	8,508	36,435
Kediri	233,244	11,413	239,728	—	78,049
Ngandjoek-Madioen	271,006	15,303	281,422	—	86,310
Solo	283,377	2,126	283,477	—	86,743
Djocja	252,022	2,073	251,934	—	73,553
Banjoemas	153,804	3,696	153,125	—	58,234
Koedoes	160,710	3,750	162,662	—	42,355
Pekalongan	125,082	964	124,792	—	31,665
Tegal	138,093	4,985	140,989	6,294	33,708
Cheribon	175,059	2,317	174,559	4,949	40,581
Total **1930**	**2,816,005**	**108,040**	**2,869,943**	**33,198**	**827,287**
,, 1929	2,745,971	149,441	2,858,054	42,300	736,700
,, 1928	2,776,430	166,339	2,901,751	72,603	694,635
,, 1927	2,279,001	83,111	2,341,538	85,051	566,102
,, 1926	1,890,544	68,142	1,941,649	98,525	593,470
,, 1925	2,205,201	77,876	2,263,479	71,679	546,520
,, 1924	1,924,942	54,427	1,966,237	82,504	483,768
,, 1923	1,740,895	31,655	1,764,636	103,842	Unknown
,, 1922	1,749,640	39,609	1,779,557	62,125	,,
,, 1921	1,632,067	34,620	1,658,032	74,892	,,

IV.—SUB-DIVISION OF THE CROP IN PERCENTAGES ACCORDING TO ASSORTMENTS.

Groups and Averages.	Plantation White Sugar First running.	Plantation White Sugar Second running.	Channel Assortment Refining Crystals, 98° Pol.	Channel Assortment Refining Crystals, 96·5° Pol.	After-products.	Total.
Sitoebondo	49·63	—	49·19	—	1·18	100
Probolinggo	39·46	—	49·72	1·47	9·35	100
Pasoeroean	30·22	—	53·87	—	15·91	100
Sidhoardjo	52·80	—	45·05	—	2·15	100
Modjokerto	83·23	—	15·72	—	1·05	100
Djombang	62·16	—	34·00	—	3·84	100
Kediri	68·92	—	26·41	—	4·67	100
Ngandjoek-Madioen	85·87	2·77	6·01	—	5·35	100
Solo	99·26	—	—	—	0·74	100
Djocja	93·62	—	5·56	—	0·82	100
Banjoemas	19·50	—	78·16	—	2·34	100
Koedoes	90·66	0·04	7·02	—	2·28	100
Pekalongan	86·69	—	12·55	—	0·76	100
Tegal	83·82	—	12·69	—	3·49	100
Cheribon	64·63	—	34·07	—	1·30	100
Average **1930**	**68·93**	**0·27**	**27·00**	**0·10**	**3·70**	**100**
,, 1929	66·42	0·49	23·29	4·64	5·16	100
,, 1928	65·54	0·35	26·35	3·44	4·32	100
,, 1927	63·60	0·30	33·50	—	2·60	100
,, 1926	59·90	0·50	17·20	19·70	2·70	100
,, 1925	56·99	0·55	18·62	21·23	2·61	100
,, 1924	54·45	0·99	25·69	16·78	2·09	100
,, 1923	53·11	1·06	28·91	15·20	1·72	100
,, 1922	52·85	1·53	27·45	16·46	1·71	100
,, 1921	53·42	0·12	28·05	15·33	3·08	100

according to these figures, disposed of 90·4 per cent. of the total Java crop of the year 1930.

Assortments.	Total Sales Tons.		Sales by U.J.S.P. Tons.
Superior "head sugar"	1,527,036	..	1,379,575
Superior soft sugar	8,002	..	73
Channel assortment 98° pol.	795,427	..	756,912
Molasses sugar	104,091	..	66,305
Bag sugar	3,952	..	19
Total Sales	2,438,508		2,202,884

Up to the 31st of December, 1929, the United Java Sugar Producers had sold only 126,800 tons of the 1930 crop. After the selling out of the 1929 crop on May 7th, the sale of the 1930 crop was resumed, but it was not until June 7th that a purchase took place of about 82,700 tons at the price of F.9 for the whites. These sales continued for about three months, so that by the end of August they amounted to 505,000 tons. On September 18th the U.J.S.P. announced a new policy, but after only two days it was again changed and was followed on October 1st by a reduction in price, so that whites were then sold at 8·50 guilders.

After the news about the "Chadbourne plan" came to hand the buying interest became general, so that on October 25th the total sales had attained the quantity of 1,360,000 tons. After that date only small sales were reported, resulting in a total sale to the end of the year of 1,605,834 tons, leaving an unsold balance of 1,007,123 tons. Of this amount 100,000 tons must be deducted, sold by the mills direct to retailers, leaving in the hands of the U.J.S.P. some 997,123 tons. In the month of January large sales were made at new limits of resp. F.8·75 and F.7·75 for consumption in the Dutch East Indies, Federated Malay States or Straits Settlements, and F.8·25 and F.7·25 for all other destinations. At the end of April the total sales amounted to 2,469,196 tons, leaving an unsold quantity in the hands of the U.J.S.P. of 500,000 tons. Assuming a price of F.8·25 for this amount, the average price of sugar per 100 kg. made by the manufacturers in Java will be as follows :—

	Guilders.
Superior "head sugar"	8·83
Head sugar	7·70
Molasses sugar	6·48
Average	8·36

The consumption in the territory of the Dutch East Indies is estimated at 393,000 tons, all the balance being available for export.

V.—Percentage Composition of Cane Plantings of :—

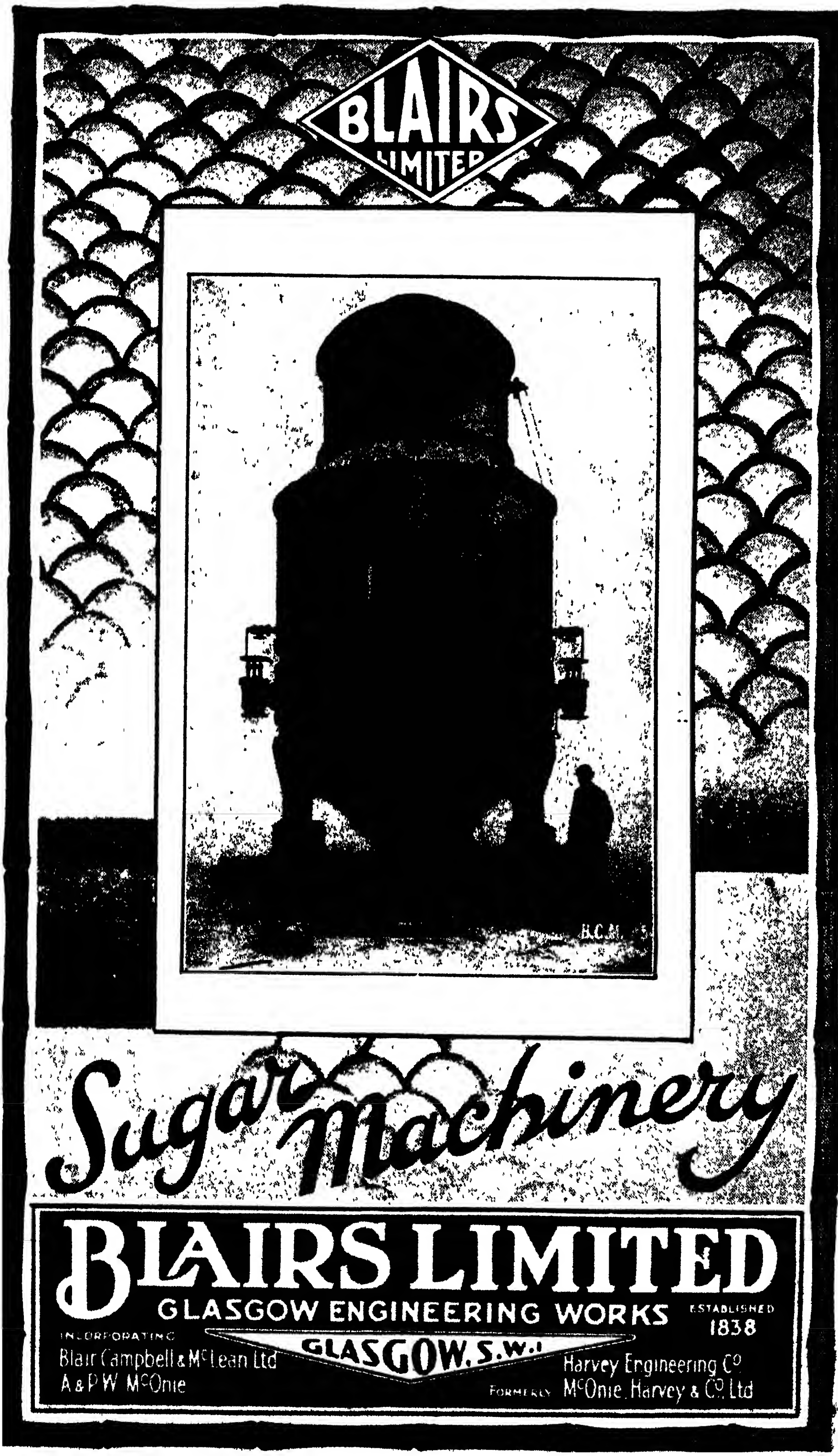
Variety.	1923.	1924.	1925.	1926.	1927.	1928.	1929.	1930.
B 247	15½	12½	8¼	4¾	1½	¼	—	—
POJ 2878	—	—	—	¾	12½	66½	93	93
Various POJ canes	6½	4¼	4¾	6¾	10¾	4¾	2	4
EK 2	6	6¼	6	5	4	¾	½	—
EK 28	40	43½	45¾	44	35¼	13	2½	1½
F 90	3	3	2¾	2½	2	½	—	—
DI 52	21½	22½	24¾	27¾	26	11¾	1¾	1
SW 3	2¾	3	3	3	2¼	½	—	—
Various	4¾	5	4¾	5½	5¾	2	¼	½
Total ..	100	100	100	100	100	100	100	100

VI.—JAVA FACTORY RESULTS DURING THE LAST SEVEN YEARS.

	1924	1925	1926	1927	1928	1929	1930
CANE—							
Sucrose	13·10	13·90	12·40	12·90	13·50	13·89	13·40
Fibre	12·90	12·80	12·80	12·70	12·70	12·70	12·70
BAGASSE—							
Sucrose	3·60	3·30	3·00	2·90	2·90	3·00	2·90
Moisture	46·30	45·50	48·70	45·50	45·20	43·80	44·70
SUCROSE EXTRACTED BY MILLS	92·80	93·90	94·35	94·73	94·07	94·60	94·70
SUCROSE IN FILTER-PRESS CAKES	4·10	3·80	3·50	3·40	3·70	3·40	3·10
SUCROSE IN JUICE PER 100 CANE	12·17	13·08	11·70	12·22	12·70	13·14	12·65
PURITY OF RAW JUICE	83·70	84·00	80·90	83·30	84·30	84·10	83·40
PURITY OF FINAL MOLASSES	30·50	30·50	30·00	29·30	30·10	31·00	30·50
CALCULATED AVAILABLE SUGAR	11·51	12·45	10·87	11·59	12·45	12·81	11·97
SUGAR EXTRACTED PER 100 CANE	11·44	12·38	10·85	11·62	12·16	12·42	11·43
SUCROSE TURNED OUT PER 100 OF :—							
Cane	10·92	11·82	10·33	10·45	11·59	11·84	12·13
Sucrose in cane	83·35	85·03	83·30	85·50	85·80	85·30	85·30
Sucrose in juice	89·80	90·40	88·30	90·50	90·70	90·10	89·90
SUCROSE LOST PER 100 OF :—							
Cane	2·18	2·08	2·07	1·77	1·91	2·05	1·27
Sucrose in cane	16·65	14·97	16·70	14·50	14·20	14·70	14·70
Sucrose in juice	10·20	9·60	11·60	9·50	9·30	9·90	10·10
LOST IN BAGASSE PER 100 OF :—							
Cane	0·93	0·85	0·71	0·68	0·73	0·75	0·70
Sucrose in cane	7·10	6·10	5·73	5·60	5·40	5·40	5·20
LOST IN FILTER-PRESS CAKE PER 100 OF :							
Cane	0·07	0·07	0·06	0·07	0·08	0·08	0·08
Sucrose in cane	0·50	0·50	0·48	0·56	0·57	0·57	0·57
Sucrose in juice	0·60	0·50	0·50	0·60	0·60	0·60	0·60
LOST IN MOLASSES PER 100 OF :—							
Cane	0·90	0·92	1·04	0·79	0·84	0·93	1·02
Sucrose in cane	6·90	6·60	8·39	6·46	6·24	6·61	7·21
Sucrose in juice	7·50	7·10	8·90	6·90	6·60	7·10	7·60
UNACCOUNTABLE LOSSES PER 100 OF :—							
Cane	0·28	0·24	0·26	0·23	0·25	0·29	0·25
Sucrose in cane	2·15	1·77	2·10	1·87	1·89	2·09	1·80
Sucrose in juice	2·10	2·00	2·20	2·00	2·00	2·20	1·90

VII.—EXPORTATION OF JAVA SUGAR IN METRIC TONS.

Destination.	1927.	1928.	1929.	1930.
Netherlands	33,002	14,823	7,774	28
Belgium	6,122	14,801	17,755	—
United Kingdom	10,791	12,293	25,662	—
France	42,963	77,506	82,958	5,843
Germany	25,917	14,673	866	250
Norway	—	51	—	—
Italy	309	1,829	6,329	1
Sweden	—	—	12,306	—
Balkan States	7,216	4,267	3,556	—
Poland	1,028	—	—	—
Other European States	308	1,120	—	—
North Africa	—	—	1,043	—
United States	206	4,806	178	50
Port Said, etc., f.o.	54,517	206,757	240,380	7,935
East Coast Africa	3,418	4,499	2,510	3,450
Arabia	645	13,648	584	950


BLAIRS LIMITED
Sugar Machinery
BLAIRS LIMITED
GLASGOW ENGINEERING WORKS
ESTABLISHED 1838
INCORPORATING
Blair Campbell & McLean Ltd
A & P W McOnie
GLASGOW, S.W.1
Harvey Engineering Co.
FORMERLY McOnie, Harvey & Co. Ltd

Destination.	1927.	1928.	1929.	1930.
British India	822,481	1,091,296	1,000,291	1,072,417
Aden	9,620	13,648	4,554	7,200
Afghanistan	—	—	127	—
Penang	24,369	25,213	26,362	25,828
Singapore	83,871	87,687	84,115	75,270
Siam	29.873	27,589	34,201	44,991
Indo China	7,311	8,463	10,593	6,673
British Malaya	—	—	6,909	11,909
Hongkong	190,892	266,083	261,474	371,645
China	173,474	322,901	312,882	287,677
Japan and Formosa	447,600	265,261	242,705	272,818
Vladivostock	6,173	3,503	2,608	1,501
Philippine Islands	173	879	15	176
Australia	513	670	219	172
New Zealand	19,676	52,474	21,065	24,107
Polynesia	—	—	1,332	1,436
Other countries	256	13,617	1,028	976
Total	2,002,729	2,549,990	2,412,381	2,223,303

VIII.—Exportation of Molasses.

Liquid.	1927.	1928.	1929.	1930.
Great Britain	149,940	62,167	31,433	18,409
United States (Pac. C.)	—	12,386	12,483	—
,, , (Atl. C.)	—	12,233	—	8,061
Aden f.o.	—	248,353	363,151	310,006
British India	64,124	41,436	47,303	89,078
Straits Settlements	293	1,453	—	—
Siam	311	—	—	970
Hongkong	16,186	18,036	19,179	16,739
China	2,187	875	266	—
Union of South Africa	—	10,439	—	75,301
Australia	113	—	—	—
Balkan States	4,064	—	—	20,710
Total	237,218	407,368	473,815	539,274
Solidified.				
Egypt	—	1,111	—	—
British India	48,157	32,462	23,798	14,695
Siam	16,216	14,085	14,131	54,419
Straits Settlements	3,065	2,281	2,230	594
Indo China	737	783	891	1,633
Hongkong	5,226	8,825	1,501	—
China	3,330	6,386	1,532	—
Australia	133	252	1,015	—
Total	76,864	66.185	45,098	71,341
General Total	314,082	473,553	518,913	610,615

The destination of the 1930 export was as detailed above in metric tons, and we give the corresponding figures for two previous years as a comparison. The stocks of sugar still existing at the beginning of the 1930 grinding season are put at 145,000 tons, and on April 30th, 1931, they were 543,942 tons.

International Sugar Council.—It is reported that the first meeting of the International Sugar Council will be held on June 22nd, in London.

The 1930-31 Sugar Beet Crop in England and Wales.

The Preliminary Returns.

The Ministry of Agriculture and Fisheries has just issued preliminary returns for the 1930-31 beet sugar manufacturing campaign in England and Wales. The area under sugar beet of 347,257 acres was the highest yet recorded in the history of the industry and showed an increase of 117,339 acres or 51 per cent. over the area of the previous year. This increase is to be attributed in part to the good results obtained in 1929 but an influencing factor also was, no doubt, the generally poor prices prevailing for other farm crops.

The weather was not, on the whole, favourable to the crop. Excessive rainfall prevented the preparation of satisfactory seed beds, while cold and wet conditions at seeding time, besides delaying this operation, also retarded germination and growth in the early stages. Subsequently the weather improved somewhat, but from the middle of June onwards rain fell incessantly in most districts with the result that when lifting commenced in late September, the crop, except on the highlands and lighter soils which had benefited rather than otherwise from the excessive moisture, was in a backward state. The sugar content was noticeably poor, the first weeks' deliveries averaging 15·6 per cent. only, whereas the corresponding figure for 1929 was 18·9 per cent. Although during October the ideal combination of bright days and cool nights caused the sugar content to rise rapidly, the average for the season of 16·7 per cent. was a full 1 per cent. lower than that for 1929, and also inferior to the 17·4 per cent. obtained in 1928. The yield of topped and washed beet per acre of 8·8 tons also exceeded the early expectations and, while still low as compared with Continental standards, was the highest yet attained in this country, comparing with 8·7 tons in 1929 and 7·7 tons in 1928. The total quantity of beets delivered to the factories in 1930 was about 3,042,000 tons, or over one million tons more than in 1929. The reduction in sugar content previously noted was reflected in the lower beet prices which averaged 49s. 10d. as against 52s. 11d. and 51s. 11d. respectively in 1929 and 1928. The reduced sugar content was also responsible for a reduction in the yield of commercial sugar per acre which on the production of 8,450,000 cwts. of sugar averaged approximately 2,720 lbs. or about one cwt. per acre less than in 1929. The tare, which rose considerably as a result of the adverse climatic conditions from November onwards, was higher than usual, being 14·8 lbs. per cwt. of beet as against 13·4 lbs. and 14·5 lbs. respectively in 1929 and 1928. The quantity of dried pulp produced was about 195,000 tons, of which 117,000 was plain and 78,000 tons molassed. About 6 per cent. of the dried pulp was exported. The production of wet pulp was about 35,000 tons.

A feature of the 1930 season was the unusually large scale on which clamping was resorted to, upwards of 35,000 tons of beet being conserved for one factory alone by this means. It was reported that when clamped in good condition the roots showed little appreciable loss either in weight or sugar content when the clamps were opened up, and when for any reason delivery to the factory could not be made until after the end of November, it was preferable in 1930 to lift and store the roots rather than leave them in the ground.

Mauritius Acreage under Cane.—According to figures supplied by the Mauritius Department of Agriculture, the area under sugar cane at the beginning of 1930 was 137,182 acres. Of this 48,525 acres were worked by mill estates ; and the total Indian cane cultivation was 52,740 acres or 38·5 per cent. of the total acreage.

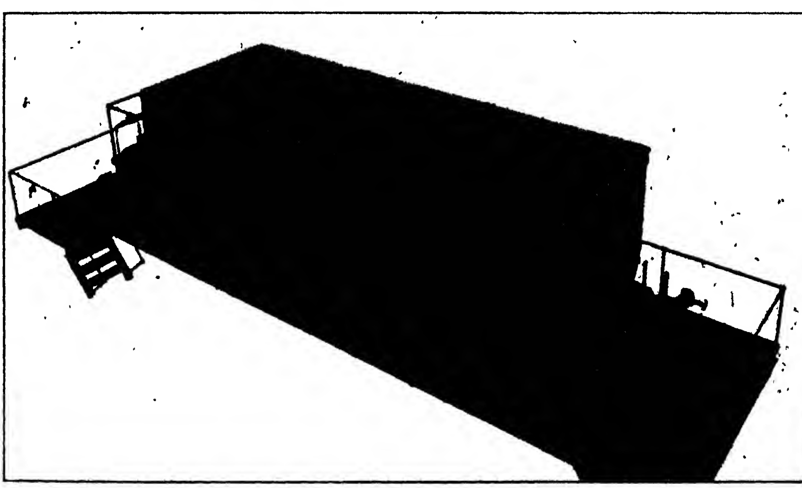
Results obtained with the "Werkspoor" Rapid Crystallizer in Java.

As already mentioned in a previous article,[1] Werkspoor supplied its first rapid crystallizer to the Poerwodadie s.f., Java, where it was subjected to exhaustive trials during the 1929 campaign under the supervision of the Experiment Station there, the following conclusions being definitely arrived at :—

(1) Massecuite cooled in a Werkspoor rapid crystallizer contained considerably more crystal than the same massecuite cooled in an ordinary type crystallizer. (2) The colour of the crystals formed in the Werkspoor rapid crystallizer was better than that of the massecuite obtained either with the ordinary type crystallizer or with the Lafeuille.

This meant that, all other conditions being equal, one could work with one strike less by using a Werkspoor rapid crystallizer instead of the ordinary type. Compared to the old method of working, the total quantity of massecuite was consequently 15 per cent. less. Both the quantity and the density of the clarified juice, the syrup and the molasses were the same with the new and the old methods of working.

Owing to the possibility of doing away with one strike, fuel economy showed a marked improvement, this being shown by an increase in the surplus bagasse. Further, syrups and massecuites could be treated much more



quickly, due to their decreased viscosity. Practical experience with the rapid crystallizer at Poerwodadie showed that the molasses from the *A*-strikes had a purity 7 to 10° lower than in the case of that obtained with the ordinary type of crystallizer.

In the 1930 campaign further very favourable results were obtained, and it was on account of these that the Nederlandsche Handel-Mij. ordered two more Werkspoor rapid crystallizers for operation during the following season. During 1931, therefore, the following five rapid crystallizers will be working in the factories of that company :—Two in the Poerwodadie s.f., installed in 1929 and 1930 ; one in the Loewoeng Gadjah s.f., installed in 1930 ; one

[1] *I.S.J.*, 1930, 306-308.

in the Ketanggoengan West s.f., installed in 1931; and one in the Wonopringgo s.f., installed in 1931.

In reference to the results obtained in the Poerwodadie s.f., the following figures have been received for the 1928 season without the Werkspoor rapid crystallizer and for 1930 when that apparatus was working :—

TABLE I.

	1930. With the Werkspoor.		1928. Without the Werkspoor.
Daily cane capacity in kg.	1,744,300	..	1,746,200
Brix raw juice	17·00	..	17·48
„ thin juice	14·35	..	15·40
„ thickened juice	59·50	..	61·00
Per cent. fibre on cane	12·00	..	12·27
Per cent. maceration on fibre	151·80	..	147·50
Hl. of massecuite per 100 of raw Brix juice	140·40	..	160·20
Calories required per kg. of Brix raw juice	2947·00	..	3192·00
Excess bagasse per 100 total bagasse	7·14	..	5·52

Attention is called in the above table to the figures for the Hl. of massecuite per 100 of Brix of the raw juice, for the calories required per kg. of Brix of the raw juice, and also for the excess of bagasse.

In Tables II and III following are given control figures for massecuites, where striking differences will be observed in the case of the *B*-massecuites (*a*) not treated in the rapid crystallizer, and (*b*) treated in that apparatus.

TABLE II.

Analyses of the Massecuite. Brix.	Pol.	Purity.	Analysis of the Syrup. Brix.	Pol.	Purity.	Exhaustion.	No. of Panstrikes.	
93·35	69·65	74·60	83·50	40·92	49·00	25·60	1249	III
93·85	71·90	76·60	82·15	43·21	52·60	24·00	1250	IV
93·50	71·35	76·30	81·70	37·91	46·40	29·90	1251	V
94·40	70·30	74·50	81·85	40·35	49·30	25·20	1252	VI
93·85	70·05	74·60	83·75	41·62	49·70	24·90	1253	VII
93·55	71·20	76·10	78·10	39·52	50·60	25·50	1254	VIII
93·50	70·95	75·60	83·00	42·99	51·80	23·80	1255	IX
95·05	69·40	73·10	83·00	40·67	49·00	24·10	1248	II
93·90	72·05	76·70	83·80	41·31	49·30	27·40	1247	I
93·84	70·66	75·30	82·32	40·91	49·70	25·60	Average.	

TABLE III.

Date 1930.	Temp. massecuite when dropped.	Temp. after crystallization.	Purity of massecuite.	Purity of syrup after centrifuging.	Exhaustion.	Remarks.
Sept. 10	61°C.	48°C.	73·50	47·30	25·50	*B*-massecuite Pan strikes No. 277-307; *Not treated in rapid Crystallizer.*
„ 11	62°C.	49°C.	72·30	46·90	25·40	
„ 13	60°C.	47°C.	71·90	45·80	26·10	
„ 14	61°C.	48°C.	71·80	46·10	25·70	
„ 15	59°C.	46°C.	71·80	45·70	26·10	
„ 16	62°C.	49°C.	72·90	47·10	25·80	
„ 17	60°C.	48°C.	71·40	47·00	24·40	
„ 20	62°C.	44°C.	71·00	43·80	27·50	*B*-massecuite Pan strikes No. 316-333; *Treated in rapid Crystallizer.*
„ 21	63°C.	41°C.	69·60	42·10	27·50	
„ 22	60°C.	40°C.	70·10	41·20	28·90	
„ 23	61°C.	43°C.	70·90	42·50	28·40	
„ 24	63°C.	40°C.	70·50	42·80	27·70	

As regards the working of the Werkspoor rapid crystallizer in beetroot sugar factories, the following cooling times would be required : 1st product, 1 hour ; 3rd product, from 12 to 18 hours. By cooling time is meant the time required for any part of the massecuite to pass from the inlet to the outlet of the continuously working cooler.

Rapid crystallizers for 1st products are fitted with cooling pockets only ; for the 2nd product, crystallizers of about $\frac{3}{4}$ of the total number of pockets are used for cooling, whereas the remaining ones may serve either for cooling or heating the massecuite. Crystallizers for the 3rd product, however, have besides pockets suitable for either cooling or heating, a number of plain discs which assist in the propulsion of the massecuite from one end of the crystallizer to the other.

Re-arrangement of Brix and Gravity Tables.

By PERCY F. STOTON, B.Sc., A.I.C.,
Chief Chemist, Ipswich Beet Sugar Factory.

In organizing routine laboratory work for a sugar factory using a saccharimeter with normal weight 26 grms. at 20°C., modern glassware graduated in millilitres at 20°C. and hydrometers adjusted at 20°C., it was found that the necessary specific gravity tables for sugar solutions at 20°C./20°C. were not readily available. Those published by the U.S. Bureau of Standards were in a form necessitating an awkward calculation to obtain the Brix from any given value of specific gravity, and further calculations to obtain the Volume Brix and the Brix of the solute in the case of normal solutions.[1]

It was desirable to have strictly comparative and as far as possible true figures for the Brix of all products from raw juices to molasses. Consequently the following tables had to be constructed to give the required figures easily from the specific gravity of the normal solution of sugar-house products and thick-juice, and the specific gravity of the original raw and thin juices. First the values given in the available tables for the specific gravity of solutions of known Brix (weight in 100 grms). were used to obtain values for the Volume Brix or weight in 100 ml. of solution by the formula :—

Volume Brix = Brix × Sp. Gr. 20°C./20°C. × 0·998234

(1 ml. of water at 20°C. weighs 0·998234 grm.)

or the formula :—

Volume Brix = Brix × Sp. Gr. 20°C./4°C.

(1 ml. of water is the volume of 1 grm. at 4°C.).

From the table so constructed, but not reproduced here, values were obtained by simple proportion for the Brix and Volume Brix for values of the Specific Gravity 20°C./20°C. increasing by 0·0005 from 1·0000. Also, over the useful range, the Brix of the solute was calculated when the specific gravity 20°C./20°C. was that of a normal solution by the formula :—

Brix of solute = Volume Brix of normal solution/0·26.

Only that part of the complete table so constructed is reproduced here which is likely to be of use in ordinary routine work. A mean difference table has been added which will be found sufficiently accurate over the whole table for routine work. This table has now been in use for two campaigns. It has thoroughly justified the work done in calculating it, since all juices and sugar-house products can be dealt with by the same method, and the figures required can easily be found from the reading, corrected for temperature, of a sp. gr. hydrometer of range 1·04 to 1·10 adjusted at 20°C.

[1] Dept. of Commerce, Technologic Papers, Vol. II, 1918-19, No. 115, F. J. Bates and H. W. Bearce.

Sp. Gr. 20°C/20°C.	Brix. Wt. in 100 grms. Solution.	Vol. Brix. Wt. in 100 ml. Solution.	Brix. Solute in Normal Solution.
1·01 50	3·83	3·881	—
1·01 55	3·96	4·011	—
1 60	4·08	4·141	—
1 65	4·21	4·269	—
1 70	4·33	4·399	—
1·01 75	4·46	4·530	—
1 80	4·58	4·659	—
1 85	4·71	4·789	—
1 90	4·84	4·918	—
1 95	4·96	5·049	—
1·02 00	5·09	5·180	—
2 05	5·21	5·310	—
2 10	5·34	5·440	—
2 15	5·46	5·570	—
2 20	5·59	5·698	—
1·02 25	5·71	5·828	22·42
2 30	5·84	5·959	22·92
2 35	5·96	6·089	23·42
2 40	6·08	6·218	23·92
2 45	6·21	6·348	24·42
1·02 50	6·33	6·479	24·92
2 55	6·46	6·609	25·42
2 60	6·58	6·739	25·92
2 65	6·70	6·870	26·42
2 70	6·83	6·999	26·92
1·02 75	6·95	7·130	27·42
2 80	7·08	7·260	27·92
2 85	7·20	7·390	2842
2 90	7·32	7·519	28·92
2 95	7·44	7·650	29·42
1·03 00	7·57	7·781	29·93
3 05	7·69	7·911	30·43
3 10	7·81	8·040	30·93
3 15	7·94	8·171	31·43
3 20	8·06	8·302	31·93
1·03 25	8·18	8·431	32·43
3 30	8·30	8·561	32·93
3 35	8·42	8·691	33·43
3 40	8·55	8·821	33·93
3 45	8·67	8·951	34·43
1·03 50	8·79	9·082	34·93
3 55	8·91	9·212	35·43
3 60	9·03	9·343	35·93
3 65	9·16	9·474	36·44
3 70	9·28	9·604	36·94

Sp. Gr. 20°C/20°C.	Brix. Wt. in 100 grms. Solution.	Vol. Brix. Wt. in 100 ml. Solution.	Brix. Solute in Normal Solution.
1·03 75	9·40	9·735	37·44
3 80	9·52	9·864	37·94
3 85	9·64	9·995	38·44
3 90	9·76	10·126	38·94
3 95	9·88	10·256	39·44
1·04 00	10·00	10·387	39·95
4 05	10·13	10·518	40·45
4 10	10·25	10·648	40·95
4 15	10·37	10·778	41·45
4 20	10·49	10·909	41·96
1·04 25	10·61	11·039	42·46
4 30	10·73	11·170	42·96
4 35	10·85	11·301	43·46
4 40	10·97	11·432	43·97
4 45	11·09	11·561	44·47
1·04 50	11·21	11·691	44·97
4 55	11·33	11·823	45·47
4 60	11·45	11·953	45·97
4 65	11·57	12·083	46·47
4 70	11·69	12·213	46·97
1·04 75	11·81	12·346	47·49
4 80	11·93	12·477	47·99
4 85	12·05	12·607	48·49
4 90	12·16	12·738	48·99
4 95	12·28	12·869	49·49
1·05 00	12·40	13·000	50·00
5 05	12·52	13·130	50·50
5 10	12·64	13·259	51·00
5 15	12·76	13·390	51·50
5 20	12·88	13·522	52·01
1·05 25	13·00	13·653	52·51
5 30	13·11	13·782	53·01
5 35	13·23	13·914	53·52
5 40	13·35	14·045	54·02
5 45	13·47	14·176	54·52
1·05 50	13·59	14·308	55·03
5 55	13·70	14·437	55·53
5 60	13·82	14·569	56·03
5 65	13·94	14·699	56·53
5 70	14·05	14·830	57·04
1·05 75	14·17	14·961	57·54
5 80	14·29	15·093	58·05
5 85	14·41	15·223	58·55
5 90	14·52	15·353	59·05
5 95	14·64	15·484	59·55

Re-arrangement of Brix and Gravity Tables.

Sp. Gr. 20°C/20°C.	Brix. Wt. in 100 grms. Solution.	Vol. Brix. Wt. in 100 ml. Solution.	Brix. Solute in Normal Solution.
1·06 00	14·76	15·616	60·06
6 05	14·87	15·746	60·56
6 10	14·99	15·877	61·07
6 15	15·11	16·008	61·57
6 20	15·22	16·139	62·07
1·06 25	15·34	16·269	62·57
6 30	15·46	16·400	63·08
6 35	15·57	16·532	63·58
6 40	15·69	16·663	64·09
6 45	15·80	16·794	64·59
1·06 50	15·92	16·926	65·10
6 55	16·04	17·058	65·61
6 60	16·15	17·188	66·11
6 65	16·27	17 319	66·61
6 70	16·38	17·451	67·12
1·06 75	16·50	17·580	67·62
6 80	16·61	17·712	68·12
6 85	16·73	17·844	68·63
6 90	16·84	17·975	69·13
6 95	16·96	18·106	69·64
1·07 00	17·07	18·237	70·14
7 05	17·19	18·368	70·65
7 10	17·30	18·501	71·16
7 15	17·42	18·631	71·66
7 20	17·53	18·762	72·16
1·07 25	17·65	18·894	72·67
7 30	17·76	19·024	73·17
7 35	17·88	19·155	73·67
7 40	17·99	19·288	74·18
7 45	18·10	19·419	74·69
1·07 50	18·22	19·550	75·19
7 55	18·33	19·681	75·70
7 60	18·45	19·812	76·20
7 65	18·56	19·944	76·71
7 70	18·67	20·075	77·21
1·07 75	18·79	20·207	77·72
7 80	18·90	20·338	78·22
7 85	19·01	20·470	78·73
7 90	19·13	20·602	79·24
7 95	19·24	20·733	79·74
1·08 00	19·35	20·864	80·24
8 05	19·47	20·996	80·75
8 10	19·58	21·126	81·25
8 15	19·69	21·258	81·76
8 20	19·80	21·391	82·27

Sp. Gr. 20°C/20°C.	Brix. Wt. in 100 grms. Solution.	Vol. Brix. Wt. in 100 ml. Solution.	Brix. Solute in Normal Solution.
1·08 25	19·92	21·521	82·77
8 30	20·03	21·653	83·28
8 35	20·14	21·784	83·79
8 40	20·25	21·916	84·29
8 45	20·37	22·048	84·80
1·08 50	20·48	22·179	85·30
8 55	20·59	22·312	85·82
8 60	20·70	22·443	86·32
8 65	20·81	22·574	86·82
8 70	20·92	22·706	87·33
1·08 75	21·04	22·838	87·84
8 80	21·15	22·969	88·34
8 85	21·26	23·101	88·85
8 90	21·37	23·232	89·35
8 95	21·48	23·363	89·86
1·09 00	21·59	23·495	90·37
9 05	21·70	23·627	90·87
9 10	21·82	23·759	91·38
9 15	21·93	23·891	91·89
9 20	22·04	24·023	92·40
1·09 25	22·15	24·155	92·90
9 30	22·26	24·287	93·41
9 35	22·37	24·418	93·91
9 40	22·48	24·550	94·42
9 45	22·59	24·682	94·93
1·09 50	22·70	24·815	95·44
9 55	22·81	24·945	95·94
9 60	22·92	25·078	96·45
9 65	23·03	25·209	96·96
9 70	23·14	25·341	97·47
1·09 75	23·25	25·473	97·97
9 80	23·36	25·605	98·48
9 85	23·47	25·737	98·99
9 90	23·58	25·869	99·50
9 95	23·69	26·002	100·01

Mean Differences.

0·00 01	0·02	0·026	0·10
0 02	0·05	0·052	0·20
0 03	0·07	0·079	0·30
0 04	0·09	0·105	0·40

Crystallization of Low Purity Massecuites.[1]

By S. J. SAINT, B.Sc., A.I.C., Department of Science and Agriculture, Barbados.

Although it is desirable that sucrose shall crystallize readily and rapidly from the mother-liquor, it is important that this crystallization shall take place under strictly controlled conditions so that it shall deposit on the surface of the crystals already present. Hence those conditions of supersaturation and viscosity of the mother-liquor must be determined and maintained which will give the greatest recovery of sucrose as crystals in as expeditious a manner as is possible under conditions which preclude false grain formation.

A factor which will modify them to a greater or lesser degree will be the area of crystal surface exposed to the mother-liquor. This factor is a very important one and has never been considered in any quantitative way. Its non-recognition may prove the main reason why such variable results are reported by investigators on the rapid cooling of massecuites. In the experiments described in this paper the number of crystals are in the order of 20,000 per c.c. of the final massecuites.

(1) SUPERSATURATION OF THE MOTHER-LIQUOR.

At a given temperature the supersaturation of the mother-liquor increases with the concentration of sucrose in solution ; at a given concentration of the mother-liquor, the supersaturation increases as the temperature decreases.

(*a*) *Concentration.*—In boiling the concentration of the mother-liquor is maintained at certain definite supersaturations during the actual drawing in of syrup or molasses, but before striking the massecuite from the pan the concentration and supersaturation of the mother-liquor are raised. This final concentration necessarily increases the supersaturation and hence the velocity of crystallization, so that more sucrose will be forced out of solution and, as would be expected, the degree of concentration attained has a considerable effect on the purity of the mother-liquor. In Table 1 figures are given for two final low purity strikes which were boiled respectively to 93·5 and 95·5° Brix.

TABLE I.

Massecuite. Brix.	Massecuite. True Purity.	Mother Liquor (at time of striking). True Purity.	Mother Liquor (at time of striking). Coefficient of Supersaturation.	Crystal Sugar in Massecuite (at time of striking). Per Cent.
93·5	63·5	56·6	1·13	13·95
95·5	62·9	48·7	1·25	24·68

These figures illustrate the marked effect which concentration of the final massecuite has upon the supersaturation of the mother-liquor and the percentage of crystal sugar remaining in the massecuite. They also indicate that the supersaturation of the mother-liquor in the concentrated low purity strikes is lower than is generally recognized. DEERR[2] considers that the coefficient of supersaturation of the mother-liquor of low grade products when dropped from the pan should be between 1·5 and 1·6, but it is very doubtful whether such high supersaturations are obtained in practice.

It is of interest to compare the sucrose status of the two massecuites given in Table I. If it is assumed that 20 tons of massecuite are discharged from the pan, then from the data collected it can be calculated that the 93·5° Brix massecuite will contain 2·79 tons of crystal sugar and 17·21 tons of mother-liquor. The mother-liquor will contain 8·3 tons of sucrose, of which 0·96 tons will be in supersaturated solution.

In the case of the 95·5° Brix massecuite, there will be 4·94 tons of crystal sugar and 15·06 tons of mother-liquor when the massecuite is discharged from the pan. It can be further calculated that the mother-liquor will contain

[1] Abridged from *Tropical Agriculture*, 1931, 8, 3-10.
[2] "Cane Sugar," 1921, p. 388.


The Maxwell-Boulogne
PATENT
Simplified JUICE SCALE
NOW THE CHEAPEST
STILL THE MOST
ACCURATE
AUTOMATIC SCALE
Extract from certificate received from Java Proefstation Pasoeroean
"—It is the most accurate weighing machine which exists, it is perfectly mechanical and automatic and needs no supervision. Its construction is so strong that it will, for years, need no repair."
The Director of the Java Experiment Station
(Signed)
Dr. Ph. van Harreveld
59 WORKING IN JAVA
Weighing Raw Juice, Imbibition Water, Syrup, Molasses, and Diluted Filter Mud.
GEORGE FLETCHER & CO. LTD.
DERBY
ENGLAND

6·33 tons of sucrose in solution, of which 1·27 tons will be in supersaturated solution.

These figures afford a good demonstration of the fact that the extent to which the concentration of the massecuite is carried before its discharge into the crystallizer has a very considerable influence on the crystallization of sucrose from the mother-liquor. SKORBILIN[1] concludes that the main crystallization of massecuites takes place in the vacuum pan and that this crystallization cannot be subsequently done in the crystallizer.

(*b*) *Temperature.*—The solubility of sucrose decreases with the temperature ; hence the massecuite is allowed to cool in the crystallizer so that more sucrose may be crystallized. In the cane sugar industry the U-shaped crystallizer equipped with some kind of stirring device, but not fitted with any method of cooling control, is the main type in use. In the past few years considerable publicity has been given to the LAFEUILLE crystallizer[2] in which the cooling of the massecuite is carried out rapidly.

The present study of the sucrose status of low purity massecuites during the cooling process was carried out in the usual U-type crystallizer which was fitted with a spiral stirrer but no cooling device. SALINAS[3] quotes figures to show that considerable inversion of sucrose takes place during the cooling of massecuites in crystallizers. The results of our analyses which are given in Table II are in accord with the work of GEERLIGS and others, and show no support for the contention of SALINAS. The reaction of the diluted massecuite determined electrometrically gave *pH* 6·2. At this reaction some slight inversion may have been suspected after five days in the crystallizer.

TABLE II.

Time.	Brix.	Polarization.	Apparent Purity.	Dry Matter.	True Sucrose.	True. Purity.
At discharge	95·50	51·50	53·9	89·62	56·08	62·57
12 hours later	95·50	51·50	53·9	89·62	56·38	62·91
24 „ „	95·35	51·75	54·3	89·22	56·14	62·91
36 „ „	95·40	51·90	54·4	89·28	56·50	63·27
*60 „ „	94·90	47·25	49·8	88·60	52·54	59·29
84 „ „	—	—	—	88·79	55·89	62·95
108 „ „	95·40	52·00	54·5	89·54	56·21	62·77
132 „ „	95·10	51·25	53·9	89·40	56·04	62·68

* This sample was taken after stirring had ceased for 12 hours and the lowering of the purity is due to the settling out of crystals.

The effect of cooling on the exhaustion of the mother-liquor in the crystallizer has been investigated by the separation and analysis of samples of mother-liquor over different time intervals. These analyses made possible the calculation of the coefficients of supersaturation of the mother-liquor and the percentage of crystal sugar in the massecuite during the period that the massecuite remained in the crystallizer. A typical example of such a series of analyses is given in Table III.

One of the striking facts brought out by these figures is the constancy of the coefficient of supersaturation during the entire period of cooling in the crystallizer. The crystal sugar increased during this period from 24·70 per cent. to 36·02 per cent. and it follows that the additional sucrose which crystallizes from the mother-liquor was due entirely to the fall in solubility of the sucrose in the cooling mother-liquor and not to any reduction in the supersaturation.

[1] *Nauchnie Zapiski*, 1927, 5 203-4. [2] *I.S.J.*, 1927, 111, 361 ; 1928, 99 ; 1929, 388 ; 1930, 204.
[3] *I.S.J.*, 1929; 147-148.

TABLE III.

Time.	Dry Matter.	True Purity.	Temperature of Massecuite.	Coefficient of Supersaturation.	Per Cent. Crystal Sugar.
At discharge	86·51	50·26	68	1·270	24·70
2 hours later	86·33	48·94	66	1·221	26·34
12 ,, ,,	85·60	46·40	60	1·223	29·34
24 ,, ,,	85·11	44·47	52	1·236	31·47
36 ,, ,,	84·37	43·34	46	1·227	32·63
48 ,, ,,	84·20	42·30	42	1·225	33·69
60 ,, ,,	84·27	41·53	38	1·258	34·42
72 ,, ,,	84·26	40·72	36	1·262	35·16
84 ,, ,,	83·94	40·01	35	1·246	35·84
118 ,, ,,	83·90	39·81	32	1·253	36·02

Since the coefficient of supersaturation remained more or less constant during the whole of this period, it is obvious that the temperature which, in this case, will be the only factor controlling the viscosity of the mother-liquor, has a very big influence on the velocity of crystallization. SANDERA[1] has shown that a definite temperature range exists within which crystallization can take place. This range is controlled by the temperature at which the solution ceases to be supersaturated at one extreme and by the temperature corresponding to the viscosity at which crystallization can begin on the other. Below 35°C. and under the conditions already defined, the viscosity of the mother-liquor is beginning to reach the limit at which crystallization ceases for all practical purposes. It is also apparent that there is a big drop in the velocity of crystallization when the temperature falls below 60°C.

The sucrose status of the massecuite has been set out in Table IV. At the time of curing 0·85 tons of sucrose remained in supersaturated solution. This sucrose will eventually crystallize out as false grain and this false grain will amount to 6·6 per cent. of the final molasses. KALSHOVEN[2] found the final molasses of 80 Java sugar factories gave an average crystal content of 8 per cent. HARLOFF[3] in 1919 calculated that this was equivalent to a loss of more than 35,000 tons of sugar per annum to Java. An examination of 18 samples of Mauritius molasses by TEMPANY[4] showed that the average fine grain content was only 1·18 per cent. It is evident that the supersaturation of the final molasses in Mauritius at the time of curing is much less than in Barbados or Java.

TABLE IV.

Time.	Tons Sucrose as Crystals.	Tons Sucrose crystallized out in each 12 hours.	Tons Sucrose in Mother-Liquor.	Tons Sucrose in Supersaturated Solution.
At discharge	4·94	—	6·51	1·39
12 hours later	5·87	0·93	5·57	1·02
24 ,, ,,	6·29	0·42	5·14	0·98
36 ,, ,,	6·53	0·24	4·73	0·88
48 ,, ,,	6·74	0·21	4·56	0·84
60 ,, ,,	6·88	0·14	4·49	0·92
72 ,, ,,	7·03	0·15	4·40	0·92
84 ,, ,,	7·17	0·14	4·23	0·83
118 ,, ,,	7·20	0·03	4·19	0·85

[1] *Zeitsch. Zuckerind. Czecho Slov.*, 1928-29, 53, 341. [2] *Archief*, 1919, 1560. [3] *I.S.J.*, 1919, 608.
[4] *Bull.* 21, *Dept. of Agric.*, Mauritius, p. 8; *I.S.J.*, 1921, 410.

(2) Viscosity of the Mother-Liquor.

CLAASSEN[1] in experiments controverting the mechanical theory of molasses formation has shown that the viscosity of a sugar syrup does not *prevent* sucrose from crystallizing from solution, but it does retard the rate of crystallization. He also showed that the two main factors governing the viscosity of sugar syrups are temperature and concentration of sucrose. He considers[2] that the increases in the coefficient of supersaturation have much greater effects on the viscosity of sugar syrups than similar increases in the non-sugar content.

He has also determined the variation of viscosity with temperature for a concentrated molasses and shows that the curve is almost horizontal from 10 to 35°C., but inclines towards the vertical at 70 to 80°C. KUCHARENKO[3] in more recent experiments has determined the effect of both supersaturation and temperature on the viscosity of pure sucrose solutions. His results confirm the findings of CLAASSEN and in addition bring out the fact that similar increases in supersaturation have a much greater effect in increasing the viscosity of sucrose solutions at lower than at higher temperatures.

It is evident therefore that in the factory where economy of space and time are important factors, the greatest relative recovery of sucrose will result under conditions which favour a low viscosity for the massecuite.

(3) Velocity of Crystal Movement.

SAVINOFF[4] has recently described some ingenious experiments showing that rotating the crystals in the supersaturated mother-liquor at 100 or more revolutions per minute increases the velocity of crystallization by as much as 500 per cent. He concludes that the velocity of crystallization which takes place under industrial conditions is far from the maximum and that the application of intensive mixing in the crystallizer would give a considerable increase in the velocity of the process.

The conditions existing in the factory are very different from those of laboratory experiments where four crystals are rotated in an excess of a pure sucrose solution possessing a low supersaturation and hence a relatively low viscosity. In the investigations carried out at Carrington Factory (Barbados) there were about 20,000 crystals per c.c. of massecuite and it can be calculated from the figures given elsewhere that the thickness of mother-liquor between crystals is in the order of 0·1 mm. Owing to the high supersaturation of this mother-liquor the viscosity is high and it will be difficult to obtain free movement of the crystal relative to its surrounding film of mother-liquor. This means that under industrial conditions where large numbers of small crystals are present per unit volume of massecuite, the deposition of sucrose from the mother-liquor in the crystallizer will be mainly by diffusion. The analyses in Table II, however, show that when stirring ceases in the crystallizer there is a lowering of purity in the surface massecuite owing to a settling out of crystals by gravity. This definitely proves that a certain amount of movement of crystal relative to mother-liquor is possible in the crystallization-in-motion of low purity massecuite. It remains to be seen therefore whether, under industrial conditions, it is possible to increase the velocity of crystallization by more intensive mixing of crystals with mother-liquor.

---

1 *I.S.J.*, 1899, 250. 2 *I.S.J.*, 1903, 280. 3 "The Crystallization of Sucrose," p. 13.
4 SAVINOFF, B. G. *Nauchnie Zapiski*, 1929, 7, 416-29.

IMPROVEMENT OF PRESENT METHOD OF CRYSTALLIZATION.

It has been shown that it is very important to ensure a greater crystallization of sucrose in the pan and a relatively high supersaturation of the sucrose in solution in the mother-liquor. This high supersaturation will necessarily entail a high viscosity which will tend to retard the velocity of crystallization. KUCHARENKO,[1] however, shows that if the temperature of the mother-liquor is high the effect on the viscosity of increasing the supersaturation of the sucrose in solution is relatively small. KUCHARENKO's results are supported by the observations made in the present investigation. Since at similar supersaturations of the mother-liquor the effect on the viscosity and hence on the velocity of crystallization is so great when the temperature falls below 60°C. it would appear logical to suggest that the temperature of the massecuite should be maintained at the striking temperature until there has been a considerable reduction in the supersaturation of the mother liquor.

As KUCHARENKO has shown, the effect of supersaturation on the viscosity of the mother-liquor at such a temperature will be relatively small and hence the velocity of crystallization will be relatively high. Reference to Table IV shows that, at the time of discharge of the 20-ton massecuite from the pan, 6·5 tons of sucrose were dissolved in the mother-liquor, of which 1·4 tons were in a supersaturated solution. A considerable amount of crystallization can thus take place without change of temperature. In the 20-ton massecuite under consideration, a drop in the coefficient of supersaturation from 1·27 to 1·1 would result in about 0·85 tons of sucrose crystallizing from the mother-liquor. This crystallization of sucrose from the mother-liquor will effect a lowering in the viscosity, but the effect of a lower viscosity of the mother-liquor on the velocity of crystallization will be offset by the reduction in the supersaturation. It may therefore be found that when the supersaturation has decreased to say 1·1, the velocity of crystallization can be increased by cooling and there is little doubt that, with the low supersaturation of the mother-liquor, this cooling could be carried out rapidly.

As shown in Table III, the mother-liquor of a cooled massecuite is considerably supersaturated and although this sucrose is theoretically recoverable, it is lost under practical factory conditions because there is insufficient time available to allow crystallization to go to completion. A recognition of this fact suggests means for facilitating the curing of such a massecuite. For instance, the temperature of the massecuite might be safely raised from 32°C. to 50°C. without fear of dissolving grain, i.e., without undersaturating the mother-liquor. This method would appear much more advantageous than the more usual method of adding water to the crystallizer, since in the former case the viscosity of the massecuite is lowered not only by a reduction in the supersaturation of the mother-liquor but also by the increase in temperature.

Additional recovery of sucrose could be effected if the temperature of the massecuite were raised and the supersaturation of the mother-liquor were kept constant by raising the concentration of the massecuite. In adopting such a method in practice there would be no necessity to boil the massecuite at a high temperature throughout. It would be sufficient to boil in the usual manner until the massecuite would be normally discharged. Instead of discharging the massecuite, boiling would be continued and the vacuum would be gradually lowered as the concentration increased so that the supersaturation of the mother-liquor remained constant. This operation could be controlled, after working out the necessary tables, with the aid of the Zeiss

[1] "The Crystallization of Sucrose," p. 13.

industrial refractometer. The massecuite would thus be maintained at a high temperature for a relatively short time and any danger due to over-heating would be minimized.

These suggestions are deduced from theoretical considerations and are to be regarded as the lines on which it would be advantageous to carry out future investigations rather than as recommendations for application to immediate practice.

A Simple and Effective Method of detecting Inversion in and around the Factory Crushing Plant.

By MAURICE BIRD, B.Sc.

Paradoxical as it may seem, while the impurities of the cane congregate largely in the last mill juice, the glucose, which must be considered an impurity in the sense that it reduces the coefficient of purity to the full extent of its presence, exists to a greater extent in the first juice expressed than in any subsequently crushed from the cane ; and further the glucose content compared even with that of the sucrose is greater in the first juice expressed than in any other from the same cane.

The explanation is probably that the glucose, being stored more largely in the top, or soft part, of the cane, exudes most readily under the first pressure. The above statement presupposes, of course, that no inversion is allowed to take place in the juices before their analyses. The writer's experience is that, with mills kept sweet and clean, the glucose ratio is invariably higher in the crusher, or first mill juice, than in the mixed juice before liming, usually by a fraction of 1 per cent., and he has used this rule as a test for inversion in and around the milling plant.

It is evident that if there is any serious inversion in the mill, as is frequently complained of, the glucose ratio must rise in the mixed juice above that of the crusher or first mill. All that is necessary for the test is to take the glucose ratio of representative (preferably continuous) samples, over several hours, of the crusher or first mill, and of the mixed, juices just before liming. Of course the samples must be preserved during collection, say, with one part of corrosive sublimate to 5000 of each completed sample.

If the glucose ratio of the former juice is the higher, all is well, but if it is equal to, or lower than the latter juice, inversion, and consequently loss of sugar, is pretty sure to be taking place. If this is found to be the case, an effective remedy is to allow a small stream of milk-of-lime to flow into the last mill juice, if this is being returned, as it should be, to the first mill or into the maceration water if this is being applied behind the first mill. Formaldehyde has been used instead of lime, with apparently excellent effect.

Of course the samples should come in contact with the preservative immediately they are expressed, to prevent any after inversion, which, of course, would vitiate the results. As the writer does not know of this test for mill inversion having been used, except by himself, he thinks it well to offer it for publication in the belief that it will be useful to others. By glucose, of course, is meant the reducing sugars of the juices.

South African Sugar Technologists' Association.

The Fifth Annual Congress of this Association was held recently at Durban with Mr. G. S. MOBERLY in the chair, and was largely attended. Interesting papers on a variety of topics relating to field and factory were presented and discussed. Following are abstracts of some of these :—

"E.C." : ITS VALUE FOR DISINFECTING MILL JUICES.

G. C. DYMOND gave the results of experiments which he had made showing that "E.C. has valuable antiseptic properties, which, when considered in conjunction with its extremely low cost of production, make its wide application desirable." E.C., or electrolytic chlorine, he pointed out, is made electrolytically from brine in a specially designed electrolyser.[1] Its manufacture is simple, and consists merely in passing a direct current through a solution of common salt in water. Hydrogen is given off at the negative electrode, and sodium hypochlorite is formed in the solution. In 1927 Dr. J. H. HALDANE reported[2] on the value of E.C. as a cheap and efficient disinfectant for cane mills, showing it to be equal to formaldehyde for preserving juices. Now the author describes experiments proving that amounts of over 10 ml. of E.C. per litre preserve the juice as well as formalin used in the dilution of 1 : 5000. In fact, in one of the experiments it was noticed that the sample of juice treated with formalin had deteriorated more rapidly even than the control. So far the use of E.C. has been restricted to intermittent application to the maceration water, which is of doubtful application on account of the great dilution. But by applying the antiseptic in the form of a spray round the mills and accessory parts its maximum disinfectant properties are exerted. Coming to the matter of expense, it is shown that E.C. costs a fraction of what formalin does in its usual dilution. Thus the cost of producing 24 gallons of E.C. per day works out at 2s. 6d. (30 lbs. of salt at 1s., and current, wages, etc., at 1s. 6d.) ; whereas formalin, used at the rate of 1 : 10,000 of water to perform the same work as the 24 gallons of E.C., would cost £2. 18s., that is about 23 times as much. The economy and value of E.C. treatment are therefore clear, and this small and inexpensive plant should be in every mill.

STANDARDIZATION OF CHEMICAL CONTROL.

The Report of the Committee concerned with this matter was read by H. H. DODDS, who dealt with the following changes in definitions made to conform with International practice : "Normal Juice" is deleted ; and dilution is to be expressed as Dilution per cent. Absolute Juice. For rapid calculation of dilution, the Brix of the Absolute Juice may be found from the Brix of the First Expressed Juice × a factor. "Last Expressed Juice" replaces "Last Roller Juice" ; and "Imbibition" replaces "Maceration" when referring to the spraying of water or juice on the bagasse, "Maceration" applying to complete immersion of the bagasse in a bath. Regarding standardization of apparatus, ml. replaces c.c. A 200 ml. flask has been adopted for polarization (see next abstract), due to the difficulty of effecting the mixing of the precipitated solution in the present type of flask ; one normal weight (26 grms.) is used, and the solution polarized in a 400 mm. tube. In colorimetric *pH* determinations, methyl red is replaced by brom-cresol green, which has a range from 3·6 to 5·2 ; but where it is possible the potentiometer (electrometric) method is to be employed. For preparing the white liquor of FEHLING's solution, 50 grms. of sodium hydroxide are used per

---

1 Agents for the sale of this apparatus in the sugar industry are The Sugar Manufacturers' Supply Co., Ltd., London. 2 *I.S.J.*, 1927, 367.

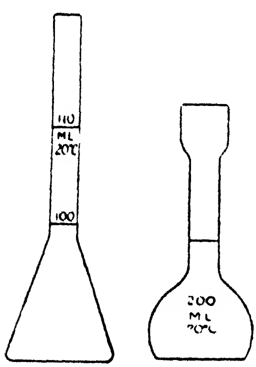
50 ml. instead of 51·6 grms. as formerly. The thymol test for the detection of very small quantities of sugars in condensed waters, etc., has been superceded by the ammonium molybdate test, used quantitatively with a set of standards. The Atkins method is proposed for the determination of phosphates in juices.

A Source of Inaccuracy in Polarizing Juices, Etc.

G. C. Dymond presented an annexure to the Report of the Committee on the Standardization of Chemical Control. He said that during 1930 crop he had observed annoying differences in the check polarizations of juices. In numerous cases the second half of the filtrate gave an appreciably higher saccharimeter reading than the first. Thus, successive portions of each filtrate gave results like tho following :—

51·10	67·50	64·75	68·00	50·65
51·35	68·05	64·15	68·30	50·90
51·45	68·15	64·25	68·50	51·10

which irregularities were proved not to be ascribed to evaporation. Following this, however, 1000 c.c. of juice were clarified as usual, made up to 2000 c.c. and well shaken. It was filtered in a variety of ways, covered and exposed, using specially dried filter-paper, but in every case, and in every successive portion of the filtrate, the same reading is obtained. It is concluded from this that "the irregularities were therefore entirely due to the inefficient mixing of the juice with the clarifying agent in the narrow-necked sugar flasks. Further tests confirmed this, and demonstrated the extreme difficulty in obtaining complete admixture by ordinary shaking, the tendency being for the dilute portion to remain in the neck of the flask. The inaccuracy was overcome by pouring out the contents of the flask into a suitable beaker, when complete admixture was easily obtained. Or, special flasks (shown herewith) may be used, *A* being for juices and *B* for sugars and filter-cake.



A B

[These results will arouse some attention. One can understand errors such as cited above occurring with juice pols. using 100 c.c. in a 100-110 c.c. flask, especially with rather gummy juices, due to difficulty in mixing together juice and lead precipitate. But when, as with sugars, filter-cake, molasses, etc., the normal weight only is present in a 100 c.c. flask there should be quite sufficient free space for mixing, and such discrepancies should not be noted.—Ed., *I.S.J.*]

Controlling Extraction of Individual Mill Units.

J. Rault read a paper on this subject. Most of the control methods which test mills under "dry crushing" conditions, he remarked, may give indications which are not in agreement with actual results obtained when milling wet bagasse. W. E. Smith[1] diagnosed abnormalities in comparison with pre-established standards by a system of density determinations on back roller juices. Though very favourably impressed with this method, the author pointed out that such figures do not appeal to the engineer to the same

[1] *I.S.J.* 1929, 673.

extent as the more familiar sugar per cent. and moisture per cent. bagasse from successive mills would if at the same time the latter could be interpreted in terms of conventional extraction at the mills. In the method of control now suggested for checking the performance of the individual mills, it is assumed that the weight of dry fibre present in cane and passing from the first to the last mill is a constant. If f = fibre per cent. cane, and f^1, f^2, and fn = fibre per cent. bagasse coming from the 1st, 2nd and nth mills, then by the ratios : $\frac{f \times 100}{f1}$, $\frac{f \times 100}{f2}$, $\frac{f \times 100}{fn}$, the weight of bagasse per cent. weight of cane is easily obtained. Knowing the bagasse per cent. cane coming from each successive mill, it is possible to calculate the loss of sugar in bagasse per cent. cane up to any particular mill if one knows the average sucrose content of the bagasse from that particular mill. Sucrose extracted per cent. cane up to any particular mill is next obtained by subtracting the sucrose lost per cent. cane in the bagasse of that unit from the total sucrose originally present in cane. Sucrose extracted by one particular mill is obtained by subtracting the sucrose extracted up to the previous mill from the sucrose extracted up to that particular mill.

SUITABILITY OF NATAL SUGARS FOR SWEET DRINKS.

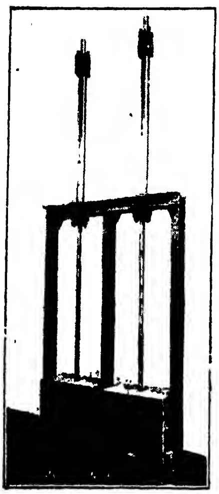
A report from refiners in Canada had stated that manufacturers of soft drinks had complained that sugars refined from South African raws were unsuitable, owing to their giving rise to a gummy ring in the neck of the bottle and to the formation of a flocculent suspension in the liquid. The matter had therefore been taken up by G. S. MOBERLY, E. P. HEDLEY and B. E. BEATER. Enquiries from local manufacturers elicited the fact that these phenomena were well known in the drinks made in South Africa, but were to be observed only in the case of drinks made from certain essences. In fact, some vendors of essences advertised that their products were especially guaranteed not to produce a gummy ring in the circumstances as described. Experiments were, however, made to decide if this were so. Eight different types of sugars, including T. & L.'s cubes, Hulsar M, No. 1 and B, Illovo, Natal Estates, Cuban Refined and Mill Whites, were made into syrups (6 lbs. to the gallon). In the liquors from each of the sugars, a certain amount of suspended matter was observed, and the T. & L. showed a number of fine hairs, which could be seen under a magnifying glass embedded in the cubes. Six typical essences and colouring matters were added to make specimen drinks, in all 72 mixtures, blanks being also made up with water alone. Results were obtained confirming that the fault for the ring formation lay with the essences rather than with the sugars. Even in the case of the mill white sugar, the ring appeared only with certain essences. The ring appeared to consist of a fine emulsion of essential oil, for the formation of which the presence of sugar was apparently necessary. A synthetic preparation showed no ring formation in any test.

REPORT ON DETERMINATION OF FIBRE IN CANE.

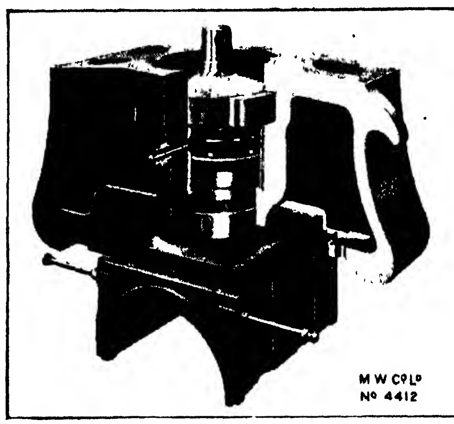
The Committee appointed to report on this matter pointed out that its real importance lies in the possibility of assigning to each load of cane an appropriate Java or Natal ratio, thus assuring a fairer distribution of sucrose under the Fahey Conference Agreement. A number of tests carried out during the 1930-31 crop consisting of 10, 20, and 40 sticks showed that the sampling error is such as to render useless any individual fibre tests based

Mirrlees'

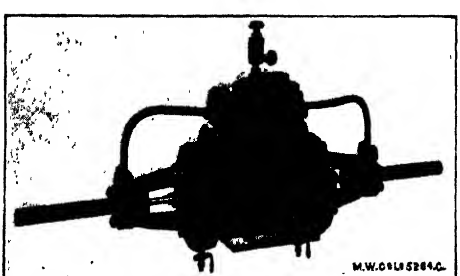
HYDRAULIC REGULATORS and ACCESSORIES for CANE MILLS.



TWIN ACCUMULATORS.



HYDRAULIC CAP.



STEAM PUMP.

HAND PUMP AND TANK.

The MIRRLEES WATSON COMPANY LIMITED

ENGINEERS, SCOTLAND STREET, GLASGOW.

London Office - Mirrlees House, 7, Grosvenor Gdns., S.W.1

055

on hand samples. They now state : "The result of four years' work shows that we are still a long way from evolving a satisfactory method of making individual fibre tests. The whole attitude of approaching the problem should be altered and the idea of fibre tests as such should be dropped. Experiments should be directed towards obtaining information on the varying "millability" of different canes and the establishing of methods for assuring a fairer distribution of sucrose between individual consignments. From the new angle of approach the Committee feels that the tests of extractability would repay further trials. In spite of certain discrepancies, it seems fairly well established that the quantity of juice extracted bears a direct relationship to the Java ratio. At present this is more apparent in the average of groups of tests than in individual tests, but better standardized conditions of experiment would probably enable us to extend the method to individual tests. Arising from this, it seems probable that very useful results could be obtained were it possible to weigh or measure the first extracted juice separately. The difficulty of such a procedure is well appreciated, but the possibility should not be lost sight of. The Committee feels, therefore, that an effort should be made to weigh or measure primary and secondary juice separately, and if possible to determine a ratio based on the proportion of primary to total juice."

Utilization of Molasses for Alcohol Motor Fuel.

C. W. Petchell called attention to the possibilities of converting molasses to absolute alcohol. Spirit of 95-96 per cent. will not mix with petrol to any extent without the use of a mixing agent as ether or benzol, the former having been used in Natal for some years past. But the use of absolute alcohol, or alcohol free from water does away with the need for any mixing agent, it being miscible with petrol in any proportions. The use of ether has certain advantages, such as raising the vapour pressure, thus making for easy starting ; but its great volatility is apt to render the fuel unstable if exposed to the temperatures prevailing in hot climates. After experiments lasting for some months, Natal Cane By-Products, Ltd., ordered an absolute alcohol plant, which has proved a complete success, and is capable of producing 2000 gallons of 100 per cent. alcohol per day. They are now marketing this absolute alcohol-petrol fuel without any ether addition. One of the main advantages of this fuel is its anti-detonating properties, it being possible to run an engine with a compression as high as 10 to 1 without any pre-ignition. When one has driven a car with the mixture, one never wants to get back to plain petrol on account of the greater flexibility, increased power, and smoother running of the engine. In France, Germany, Hungary, Italy and other countries the mixture of locally made absolute alcohol with the imported petrol is compulsory. South Africa's sugar crop last year of 393,000 tons produced 20 million gallons of molasses, enough to make 7 million gallons of absolute alcohol. As the importation of petrol for the last 12 months was about 65 million gallons, a mixture of 10 per cent. would have absorbed all the cane alcohol that could be made, and probably the wine industry could have added to this.

Dorr Clarifiers and the Petree System.

W. T. Latham, of Gledhow Sugar Estates, Ltd., after describing this process, discussed its advantages and its disadvantages as follows :—The great advantage claimed for the Petree Process is the total elimination of

the filter-press station. The substitution of Dorrs in place of the open type of clarifiers constitutes a saving in space and part of the labour required to operate the latter. It is also claimed that the added fuel value of the bagasse contributed by the return of the mud to the mills is worth a consideration, but against this must be considered the value of press-cake as a fertilizer. Here, it was realized that, although certain advantages mentioned above were to be gained, losses of sucrose and mechanical difficulties in other directions were to be met with. Owing to some extent to the uneven feed of cane to the crusher and subsequently the unevenness of the blanket of bagasse, a condition existing in many mills in this country at that time, it was found that re-expression of the mud from the bagasse and its subsequent return to the process was a factor very difficult to control, which led finally to the accumulation of mud in the clarifiers and to the further intensive circulation in the endeavour to keep the levels down. High mud levels led to decomposition of the mud, the evolution of obnoxious gases and presumably to the solution of decomposition products with its attendant loss of sucrose. Had these conditions been a prevalent feature, the process would have been at once discontinued, but they were existent chiefly after rains and after crushing cane of an inferior quality. It was realized that owing in the main to the large volumes of mud which had to be contended with in this country, that part of the process which dealt with the application of the mud to the mills was not altogether feasible, and this practice was discontinued. The process of double clarification with Dorrs in conjunction with a filter-press station is still practised and has worked successfully for a number of years."

DETERMINATION OF SUGAR IN BAGASSE.

PRINSEN GEERLIGS states that "the constituent which hot water dissolves from the fibre has a decided dextro-rotary power ; for this reason the sucrose content is found to be too high if the boiling is too prolonged." Hot water extracts optically-active dextrins and gums, and after long heating hemi-celluloses may hydrolyse with the formation of substances that affect the polarization. G. C. DYMOND now reports experiments which the chemical staff at Empangeni have carried to determine the optimum conditions of this determination. It was clear at the outset that lengthening the time of heating gives an increase in the polarization. Quite divergent figures can be obtained by varying the procedure ; thus 3·95 per cent. was found when cold water was added, this raised to boiling point, and boiling continued for 40 min., while 3·65 per cent. was the figure when boiling water was added at once, and the liquid simmered for 30 min. In another series of tests, the bagasse was mixed with boiling water, and gently boiled for 15, 30 and 45 min. : the sucrose in the extract on being determined by direct and by double polarization gave closely agreeing results, which experiments suggested the absence of dextro-rotary impurities under these conditions, even after 45 min. Another series of experiments were conducted with the use of water at 50°C., when a fairly constant figure was reached after 2-3 hours, but this figure was appreciably below that obtained by boiling. This procedure using 50°C. would seem to represent a truer sucrose content than at boiling point. Crystalloids diffuse into water with comparative rapidity, it is pointed out, whereas colloids only slowly. At 50°C., therefore, it is contended all the sugar has diffused after 2½ hours, and all increases of polarization obtained by boiling are not due to sucrose but to other dextro-rotary bodies.

Abstracts of the International Society of Cane Sugar Technologists.

Under the scheme instituted by the International Society of Cane Sugar Technologists a collection of abstracts of papers on agricultural and technical subjects is prepared monthly. A selection from these "Sugar Abstracts" has been made by us from the material issued, and appears below :—

Beet Sugar Manufacture.

Uniform Method for Conductometric (Ash) Determinations. K. Sandera. Zeitsch. Zuckerind. Czechoslov., 1930, **55**, 199-204.

A questionnaire showed that of fifteen factories in Czechoslovakia using the electrometric ash apparatus, ten employ it exclusively for factory operations, and five in the trade analysis of sugars, two of them at the same time using the ashing method. All these factories using the Sandera type of apparatus. Replies from other countries showed each to have its special apparatus and methods. Some say that the conductometric method is not a suitable substitute for the gravimetric, but others state that it can even be applied in trade analyses. As regards the method of evaluating the results, there are two principal standpoints : In one the conductivity itself is taken as the characteristic constant of the sugar solution, and according to the other the salt content is measured on an arbitrary scale. There is also wide variation in the concentration of the solutions employed, as 5, 6·5 or 26 grms. per 100 c.c. 20 to 50°Bg., or 40°Bg. Uses to which the apparatus may be put are : following changes occurring in juice purification ; for a similar purpose in the pan boiling of sugars ; for controlling sweet-waters and waste-waters. As regards internationally standardizing the conductometric method, there are no insuperable difficulties in the way. The particular apparatus used is not of great importance as long as it is simple, involves no re-calculations, is easily adjusted for temperature, is readily standardized, and is reasonably low in price. Results may be stated as corrected sulphate ash, either mathematically or mechanically, that is by no means of a percentage scale reading.

Preheating Beet Cossettes with Hot Air. V. Stanek and J. Vondrak. *Zeitsch. Zuckerind. Czechoslov.*, 1930-31, **55**, 357-360.

From time to time inventors have proposed preheating the beet cossettes before diffusion to coagulate the protoplasm in the cell before any albumen diffuses out, in order thus to obtain a purer juice and a pulp of more value as a stock feed. But on putting this idea to the test by heating the cossettes to 75-80°C. in a current of moist air, and subsequently digesting as in the diffusion process, a considerable proportion of the albumen was still found in the juice, the increase in the juice purity from the operation being negligible.

Solubilities of some Inorganic Substances. Émile Saillard. *Suppl. hebd.*, No. 2198.

The presence of magnesia in limestones and in the juice gave rise last campaign to incrustations in the pre-evaporators and first bodies, these incrustations being much favoured by the high natural alkalinity of the juice. Hence the author has carried out certain solubility determinations with the following results : 1. The solubility of magnesia and of magnesium carbonate at 20°C. in an alkaline 10-12 per cent. solution of sugar increases as the alkalinity diminishes. 2. The solubility of calcium sulphate at 20°C. in a 12 per cent. solution of sugar increases if the solution contains carbon dioxide, and remains higher after boiling the solution. 3. Magnesium sulphite is not more soluble

at 20°C. in pure 10 to 40 per cent. sugar solutions than in distilled water. 4. Gelatinous silica is only slightly soluble at 20°C. in distilled water and in a 13·5 per cent. solution of sugar, rendered alkaline with 1 grm. of CaO per litre ; but it is more soluble if the same alkalinity is reached with soda. It is more soluble at 40°C. than at 20°C.

CANE SUGAR MANUFACTURE.

Gums in Raw Sugar Solutions. H. F. Bomonti. *Proc. Hawaiian Sugar Planters' Association*, 1930.

Experiments are described in which the amount of gum (or organic matter insoluble in alcohol of a certain density) in solutions of raw sugars was determined : (*a*) In the original solution, (*b*) after filtration through kieselguhr, and (*c*) after ultra-filtration, through semi-permeable membranes of collodion. Using raw sugar solutions of 40, 50 and 60 per cent., the following results were obtained :—

	Original Solution	After Kieselguhr	After Ultra-filtration
Dye value	0·285	210·00	150·00
Gums per cent.			
40 per cent. solution	0·340	0·22	0·15
50 ,, ,,	0·330	0·24	—
60 ,, ,,	0·350	0·23	—

It appears that 65 per cent. of "gums" is found in the filtrate after filtration through kieselguhr. Another interesting point is that 45 per cent. of the gums actually pass through the semi-permeable membrane. Apparently the density of the solution does not influence the physical state of the gums.

Acidity of Cane Juice during Grinding. F. S. Gomez. *Philippine Agriculturalist*, 1931, **19**, 609-634.

In all, 1728 *pH* and acidity determinations were made as the cane passed from the crusher through the different units of a 14-roller mill, grinding Luzon White and Pampanga Red varieties. The results showed an increase in the average hydrogen-ion concentration from crusher to 4th mill, but the mixed juice is but little different from the crusher juice. However, there was no increase in the total grms. of hydrogen-ion per litre of juice from crusher to last mill when all the mills were thoroughly washed down once every shift, and when the juice troughs and pit were kept free from bagasse accumulations.

Oliver-Campbell Filter. R. C. Campbell. *Proc. Hawaiian Sugar Planters' Association*, 1930.

The principal difference between the new and the Oliver filter previously used for muds is that the first cloudy filtrate to pass through the perforated brass is withdrawn through one part of the rotary control valve, while the clear filtrate which follows is withdrawn through another. The cloudy filtrate is returned for later handling and the clear juices go direct to the evaporators. All internal parts coming in contact with the juice are made of brass ; and no hand cleaning of the drum is necessary if the juice is kept hot (176°F. or over). Its efficiency depends to some extent on the ratio of cane trash to dirt in the muds to be filtered ; the cane matter makes a good filtering layer ; the dirt usually a bad one. In some cases it may be desirable artificially to increase the amount of cane matter in the muds, which is done by installing a small motor-driven sifter for screening bagasse, which will deliver fine bagasse particles directly into the mud mixer. Addition

of these screenings greatly increases the filtration rate, and consequently the capacity of the filter. The increased polarization loss due to the added screenings is small, and even if it were many times larger would not be serious. A protracted test run with the new filter was made at Punta Alegre, which is reputed to have the worst muds in Cuba. The results showed the possibility of high sucrose recovery with little dilution of the filtrate, and a negligible drop in the purity.

Composition of Different Varieties of Canes. S. J. Saint. *Rep. Dept. Sci. Agr. Barbados*, 1929-30, 76-78.

Hawaiian chemists have raised the question whether an analysis of juice will afford an indication of the deficiencies of potash and phosphoric acid in the soil After having extensively studied this question, the author concludes that the relative composition of particular varieties of cane are subject to little variation, either when grown on different soils, or in different seasons, and that the distribution of potash and phosphoric acid between juice and bagasse is fairly constant. The actual amounts of these constituents in the juice and fibre, however, are distinctly different for different varieties. Although the chemical compositions of cane varieties relatively to one another are always about the same, the actual composition in any year depends on climatic factors (rainfall and drought). This variability due to climate would seem to militate against the utility of juice analysis as a general method of soil diagnosis.

Developments in Bagasse Furnaces. E. A. Rogers. *Proc. Hawaiian Sugar Planters' Association*, 1930.

The tendency now in Hawaii is to design furnaces that will give higher temperatures, many new installations giving 2200 to 2500, where formerly 1900 to 2000° was the maximum. The attainment of these higher temperatures is due in part to the substitution of suspended flat arches for sprung arches supported by dividing walls, thus securing greater furnace volume and a better distribution of the hot gases. Some of the installations have shown that it is perfectly practicable to obtain ratings as high as 200 per cent. of the normal, which is 10 sq. ft. per horse power rating. Fuel efficiencies of over 75 per cent. are reported from two mills. It is remarked that the sugar industry should begin to study the use of air preheaters and economizers with the possibility of using bagasse in other directions.

Refining.

Boiling Out Spent Char. N. S. Volkoff. *Naukovi Zapiski*, 1930, **10**, 294-507.

Washing spent char as a preliminary to regeneration accounts for 50 per cent of the entire amount of char charged to the account of hot water in the refinery. It should be conducted in two stages: boiling for a definite time in a definite volume of water, followed by washing with clean water within a certain definitely limited time. Char used for first syrups should be boiled not less than one and not more than 1½ hours, and on third syrups not less than two hours. Subsequent washing may be carried out with condensate at 55-60°C., but the time necessary to finish washing may be nearly halved by using water of 90-95°C.

Char or Vegetable Carbon in the Refinery. A. S. Reisser. *Naukovi Zapiski*, 1930, **10**, 279-293.

"Norit" has been used to the entire exclusion of char during the whole campaign of 197 days at the Scheptovka factory, Russia. Its cost of appli-

cation was somewhat dearer than that of char, due in part to insufficient capacity as well as to defects in the regenerating plant. The price of this carbon has lately been reduced.

Evaluating Active Carbons A. A. Sipyagin and E. S. Serkin. *Zhur. Sakh. Prom.*, 1930, **4**, 466-470.

As an improved alternative to the methods employed by the Lurgi, Metallbank, and Petrolifères concerns, the following procedure is recommended : A 5 per cent. solution of molasses, or a 25 per cent. solution of yellow sugar is treated with kieselguhr and filtered; three portions of 100 c.c. are heated in 250 c.c Erlenmeyer flasks fitted with reflux condensers, on a water bath, the first containing 0·5 grm. of the standard carbon, the second the same weight of the sample under examination (both dried to constant weight), and the third sugar solution only. The three flasks are allowed 3 min. to attain the temperature of the bath, after which they are further heated for 10 min. with constant shaking, then filtered hot. On cooling the colours are measured in a Stammer colorimeter, and the decolorizing power of the sample evaluated by the formula : $\frac{100\,(h_1 - h_0)\,h}{(h - h_0)\,h_1}$, in which h is the Stammer reading of the solution treated with the standard carbon, h_1 that of the sample under examination, and h_0 that of the untreated standard solution.

Correspondence.

BRITISH BANKS AND TRADE—A ROYAL HINT.

TO THE EDITOR, "THE INTERNATIONAL SUGAR JOURNAL."

SIR,—In your edition for April, I read Dr. FRANCIS MAXWELL'S article on "Marking Time" with great interest.

In this connexion it is interesting to note the following quotation from the "Pull Together" speech by the PRINCE OF WALES, on May 21st, in London.

> "And then there is one point in connection with our loans abroad to which my notice has been called more than once in South America. When loans are made abroad by the banks of some other great countries, they usually insist, either directly or in some indirect way, that in so far as the proceeds of the loan are to be spent on machinery or materials, the orders shall go to the manufacturers of the lending country if prices are reasonable. (*Cheers*).
>
> "I think that banks in this country have usually held that such conditions are unnecessary, because sooner or later, directly or indirectly, the money must be spent in the lending country. Probably they are right, but at the same time, in these very difficult, these very unsettled, times through which we are now passing, would they not be justified in taking steps to secure a more speedy return of the money in the form of orders ? (*Cheers*)."

It seems to me a happy coincidence that Dr. MAXWELL'S ideas should have been so quickly backed up by the Empire's principal salesman.

Yours faithfully,

C. F. ARMSTRONG.

13, Scarsdale Terrace,
Kensington, W.

Correspondence.

THE HIRSCH PROCESS.

TO THE EDITOR OF "THE INTERNATIONAL SUGAR JOURNAL."

DEAR SIR,—In *Facts about Sugar* of July 13th, 1929 (page 667), an article was published entitled "THE HIRSCH PROCESS : A Short Account of a New Process for making High Grade Sugar Direct from Cane," in which methods of making white sugar employed in the Argentine, and especially in the San Pablo factory of Tucuman, were described in such a way as to imply that these factories employ this so-called Hirsch process. Also, in *El Mundo Azucarero* of July, 1929 (page 376), reference was made to the "Hirsch Process," stating that it was in use in the Argentine, and that sugars made in this country by this process had been analysed in Cuba and shown to be of remarkably high quality.

In the number of the 19th October, 1930, of the newspaper *El Mundo* of Havana, there appeared an article entitled "On Sugar Refining : Cuba could make White Sugar at the same cost as Raws," which referred to a visit of a Mr. J. E. NORMAND (who is stated to be the "representative in Cuba" for the "Hirsch Process of White Sugar Manufacture,"), and gave a description, written by Mr. NORMAND, of this process *as carried out in the San Pablo factory of Tucuman, Argentine.* In this article the statement that the Hirsch process is employed in the Argentine in general and in the San Pablo factory in particular is frequently repeated, and in fact the analysis of a sample of sugar stated to be made by this Tucuman factory is cited as convincing evidence of the merits of the "Hirsch process." At the end of the article a full description is given of the methods of manufacture used in the San Pablo factory of Tucuman, which, it is stated, is employing the Hirsch process.

I am authorized to state that neither the San Pablo factory nor any other in this country employs this so-called Hirsch process, which indeed is totally unknown here. Some time ago the San Pablo factory, at his request, sent to Mr. J. E. NORMAND of Havana (who is quite unknown to them) a description of their sugar manufacturing methods, and a sample of their sugar, but the use of their name in connexion with the so-called Hirsch process, and the offering of their sugar as evidence of the merits of this process, is entirely repudiated by the owners of this factory.

Mr. JOSÉ PADILLA, the Manager of the San Pablo factory, would be glad to communicate to anyone interested the details of the process of white sugar manufacture for direct consumption employed by them, which they have evolved by many years of patient work and study, and by which they produce a very high grade sugar, considered equal to refined granulated, without the use of boneblack. The owners of this factory do not ask any royalty from those who wish to employ their methods ; they are glad if they are able to contribute in this way to the progress of the sugar industry in general.

Yours very faithfully,

WILLIAM E. CROSS.

Tucuman, Argentina, 28th April, 1931.

[On page 308 we reproduce an account of this "Hirsch Process" by J. E. Normand. These particulars show it to follow a sulphitation procedure for which as a whole no claim for originality can be made. Nor, judging from such details as are given, are we impressed with it as a white sugar process.—ED., *I.S.J.*]

Publications Received.

Elements of Chemical Engineering. Walter L. Badger, Professor of Chemical Engineering, University of Michigan ; and Warren L. McCabe, Assistant Professor of Chemical Engineering, University of Michigan. First Edition. McGraw Hill Publishing Co., Ltd., London). 1931. Price : 25s.

Some information regarding what we believe to be an important new introduction to the science of modern chemical engineering may be of some interest. It is based on the view-point, now being adopted in American technical education, that chemical engineering is based on unit operations. That is to say, no matter whether the student is destined to become a manufacturer of sulphuric acid, of soap, of textiles, or of sugar, he employs operations that are common to at least some of these industries, viz., the transportation of liquids, the flow of heat, extraction, filtration, evaporation, crystallization, and it may be drying, size separation, and the like. Hence the fundamental training of the chemical engineer according to this system should be concerned with a detailed study of the theory and the practice of a series of such technical operations. This at any rate is the manner of treatment of this modern textbook on chemical engineering, which is written for beginning students or for practising engineers who may lack training in the underlying theories of unit operation. One cannot but be impressed with the high order of the material presented, and, it may be added, hardly less with the drawings of plant, some 314 in number, which are worth special commendation. Chemical engineers of the sugar industry should have much interest in such an excellent work as this.

A.S.T.M. Standards, 1930. Part I, Metals; Part II, Non-Metallic Materials. (American Society for Testing Materials, 1315, Spruce St., Philadelphia, Pa., U.S.A.). 1930. Price : $7.50 each part ; or $14.00 for both parts.

This is a very important work for the indenting engineer, and especially for the industrial chemist whose duty it may be to test the materials bought or sold by his organization. It is a triennial publication containing specifications and methods of testing which have been approved only after considerable experience and deliberation on the part of various Committees of experts. Its contents can be accepted as definitely authoritative, and its value to the purchasing department of a large concern can hardly be over-estimated. Among the materials dealt with in Part I are : Rails, boiler steels, spring steel, tool steel, steel castings, steel tubes and pipes ; wheels and axles ; and in the non-ferrous section : Brasses and bronzes, brass plates and tubes, and a large variety of alloys. Part II covers cement, lime refractories, paints and pigments, lubricants, fuels, insulating materials, textile materials, thermometers, etc., etc. There are 179 standards in Part I ; and 251 in Part II, these giving specifications of considerable interest to the engineer and methods of analysis in much detail that cannot fail to be of much use to every technical chemist.

Tabellen der Zucker und ihrer Derivate. Hans Vogel and Alfred Goerg. (Julius Springer, Berlin). 1931. Price : R.M 126 bound, and RM. 120 unbound.

This book comprises a register of the sugars and especially of their derivatives, the number of which now recorded has reached an extraordinary total. It is arranged in the form of tables dealing successively with free sugars, carbonyl derivatives, alcohol derivatives, glucosides, and reduction and oxidation products. Data given in the case of each compound are : origin or preparation, m.p. and b.p., optical rotation, solubility, analytical properties, and literature. For the student of carbohydrate chemistry, it will prove a reference work of great value.

Die Glykoside. By Dr. J. J. L. van Rijn. Second enlarged and revised edition by Dr. Hugo Dieterle. (Gebrüder Borntraeger, Berlin). 1931. Price : Rm. 51 bound ; Rm. 48 unbound.

A second edition of Van Rijn's well-known monograph on the Glucosides has been called for, and has been undertaken by Prof. Dieterle, of Frankfort University. It contains an introduction discussing the glucosides generally, following which an

FARREL-BIRMINGHAM COMPANY INC.

351, Elizabeth Street, ANSONIA, CONN., U.S.A.

SUCCESSOR TO

FARREL FOUNDRY & MACHINE CO. (Est. 1848)
BIRMINGHAM IRON FOUNDRY (Est. 1836)

Representatives:

E. H. THOMAS, Manager New York Office, 79 Wall Street, New York City.

FRANK L. ALLEN, Aguiar 73, Havana, Cuba.

ENRIQUE ABARCA, San Juan, Porto Rico.

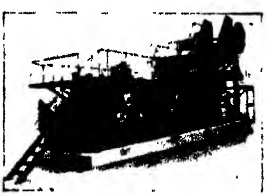
MAX W. BOLEY, Calle Alsina 743, Buenos Aires, Argentine.

AYRES & SON, Avenida Rio Branco, 76, Pernambuco, Brazil.

EDWARD J. NELL CO., 680 Dasmarinas, Manila, Philippine Islands.

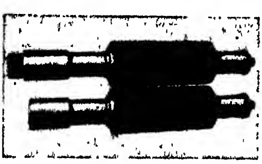
FARREL SUGAR MACHINERY:

Cane Grinding Mills; Single, Double and Multiple Crushers; Gear Drives for Mills and Crushers; Cane Knives; Cane Levellers; Cane Carriers; Intermediate Carriers; Juice Strainers and Trash Elevators; Rolls (complete); Roll Shells; Hydraulic Pressure Regulators; Hydraulic Accumulators; Speed Reduction Units; Cast Tooth, Cut Spur and Cut Double Helical Gearing; Repairs of all kinds.



Farrel Cane Mills and Crushers:

Built in single, three-roller mills or in tandems of six, nine, twelve, fifteen or more rolls with or without a crusher. Massive, well proportioned housings with metal disposed to best advantage; improved hydraulic cap of simple construction with removable cylinder having only one packing; crown wheels with specially designed teeth to give maximum variation of roll centres. Accessibility and interchangeability of parts a particular feature. Used by leading sugar producers in all parts of the world.



Farrel Rolls:

Made of a mixture of metals, which produces a hard iron of very open grain, demonstrated to be the most satisfactory by over fifty years' experience and hundreds of rolls in successful operation. Texture and quality of iron in roll shells a factor in obtaining high extraction and tonnage. Method of construction a positive prevention of shells becoming loose on the shaft.

Farrel Revolving Cane Knives:

For shredding and cutting any kind of cane, making a compact blanket which provides more uniform feed to the crusher. Made with specially shaped knives having serrated edges (patented) which increase shredding action. Expand mill capacity and raise sucrose extraction. Arranged for electric motor, engine or belt drive. Maintenance-cost is negligible.

Engineering Data, Specifications and Quotations on request.

NEW RECORDS FOR PRODUCTION AND PRECISION ARE MADE ON FARREL-BIRMINGHAM MACHINES

account of these compounds to be found in some 94 plant families is given. As heretofore, this book will comprise the most useful work of reference for the student of this branch of carbohydrate chemistry.

Limestones: Their Origins, Distribution, and Uses. F. J. North, D.Sc., F.G.S. (Thomas Murby & Co., London). 1930. Price: 16s.

A general treatise on limestones, their nature, origin, distribution, varieties, etc., this volume gives particular information on lime and lime-burning that cannot fail to be of service to the chemical technologist in his search for the purest possible grades of stone and on its conversion to oxide or to hydrate. There is a good chapter on lime and lime-burning. Modern lime-kilns are continuous in their working, and may be either of the vertical or of the rotary type, using producer gas, which leaves behind no incombustible residue to contaminate the material obtained.

Aids to Bacteriology. William Partridge, F.I.C. Fifth Edition. (Ballière, Tindall and Cox, London). 1930. Price: 5s.

This book has become much more than the "Students' Aid" it was originally intended to be, now being recognized as a very valuable handbook for the bacteriologist. In a space less than 300 of its small pages, the author has packed a great amount of information on the theory and practice of the subject generally, and particularly on fermentation, disinfection, and the bacteriology of water, soil and air. As a handbook for the practician, it can be highly recommended.

Practical Plant Biochemistry. Muriel W. Onslow, M.A., Lecturer, University of Cambridge. Third Edition. (Cambridge University Press). Price: 12s. 6d.

We call attention to this book as one of the best introductory manuals on practical plant biochemistry. It consists of explanatory matter with descriptions of experiments which are designed to enable the student to extract from the plant itself the chemical compounds of which it is constituted, the carbohydrates, colouring matters, vegetable acids, bases, glucosides, enzymes, etc., and to learn something of their properties. It forms an admirable students' textbook on the subject.

(*A*) **Sugar Beet Culture in the Humid Area of the United States.** Farmers' Bulletin No. 1637: U.S. Department of Agriculture. (*B*) **Sugar Beet Growing under Irrigation in the Utah-Idaho Area.** Farmers' Bulletin No. 1645; U.S. Department of Agriculture. (*C*) **Methods of Seed Production from Sugar Beets Overwintered in the Field.** Circular No. 153; U.S. Department of Agriculture. (*D*) **Transplanting Sugar Beets in Utah and Idaho.** Circular No. 156; U.S. Department of Agriculture. (For sale by the Superintendent of Documents, Washington, D.C., U.S.A.) 1931.

Mr. NORMAN RODGER has in preparation a new work by Dr. FRANCIS MAXWELL dealing with "Modern Milling of Sugar Cane," which promises to be one of the most important volumes relating to the sugar industry that has been issued since NOEL DEERR's "Cane Sugar" was published. This new volume will form a practical treatise on the Design, Construction, Installation, Operation, Practice and Control covering the Milling Station of modern Cane Sugar Factories; and will include about one hundred pages of illustrations, as well as a Glossary of sugar engineering terms in several languages. It will incorporate the wide experience of the author, gained in the course of his varied career and his numerous journeys all over the world, and will emphasize the point of view of the mill engineer as distinct from that of the factory chemist. It is hoped to publish this work in the Autumn, and further details will be advertised later.

Brevities.

Renold Chains.—Messrs. Hans Renold and the Coventry Chain Co., Ltd. have been re-organizing their depots in the United Kingdom, whence full technical services are available. The headquarters in London is at Bush House, Aldwych, and there are branches in Birmingham, Manchester, Leeds and Coventry.

Petree & Dorr.—We are asked to point out that an unfortunate mistake crept into Messrs. Petree & Dorr's April advertisement, owing to a slip in condensation in the preparation of the draft sent to us. At line 8 " Increase in Sucrose Extraction 33 per cent. " should have read : " Increased Extraction : The use of the Morgan Disintegrator at Central Hershey reduced the percentage of sugar left in the bagasse by 33 per cent."

Furnace Lining.—A special refractory clay, " Plibrico," largely used in various industries in the U.S.A. and U.K., has been found to be of advantage for bagasse furnace construction compared with firebrick. In applying it the old firebrick wall is removed entirely, and the new plastic material is installed next to the outer wall. It is trimmed with a trowel, and baked out with a slow fire, thus giving a solid monolithic lining without a vulnerable joint. It is claimed to be capable of withstanding temperatures up to 3100°F., and to have a life at least 100 per cent. longer than the best firebrick.

Obituary.—We regret to announce the death at Horsham, Sussex, on May 13th, of Dr. Frederick Muir, an entomological worker of the first rank, whose contributions to both pure and applied science were of the highest value. He joined the staff of the Hawaiian Sugar Planters' Association in 1905, under Dr. R. C. L. Perkins, F.R.S. He rendered that Association valuable service in establishing the optimum conditions for the control of cane pests. He recently received the honorary Doctorate of Science of the University of Hawaii, was President of the Hawaiian Entomological Society in 1913 and 1923, and Vice-President of the Entomological Society of London in 1930.

Dorr-Oliver Corporation formed.—A union of the businesses and assets of the Dorr Company and Oliver United Filters Inc. is announced, to be known as the Dorr-Oliver Corporation. It will be under the joint management of John V. N. Dorr and Edwin L. Oliver, and will function through its two, wholly owned, operating units, a new Dorr Company, Inc., and a new Oliver United Filters Inc. The businesses of the two companies are of long standing and are complementary, and the union will make it possible for the concerns to offer to industry a more complete line of equipment and engineering service than either company could hope to offer individually.

Laboratory Innovations.—Among recently introduced general equipment for the laboratory one notices : Petrie dishes of "Pyrex" glass, which is heat-resistant and alkali-free. Various forms of "shakers" for inducing rapid precipitation, e.g., in phosphorus determinations. New drying agents, better than $CaCl_2$, sulphuric acid, KOH or NaOH, and capable of regeneration. Glassware with connexions of ground glass guaranteed to fit perfectly and to be vacuum tight, so that if for example the inner tube of a condenser were broken it could be replaced to accurately fit the connexion of the water-jacket. Extra tough filter-paper for pressure and vacuum filtrations, capable also of use for caustic alkali filtrations. Turbidimeters for determining sulphates and other precipitates by comparison with a standard precipitate. Lastly, balances with a " keyboard multiweight carrier," which ensures great speed in weighing with a high degree of accuracy at the same time.

Sugar Analysis Commission.—It is possible to announce that after considerable negotiation the International Commission for Uniform Methods of Sugar Analysis is about to be re-convened. The first meeting since the war will take place at the University of Amsterdam, on Monday, September 7th, this year, at 10 a.m., and the session will last several days. Subjects to be considered by the Commission will probably include the following: The 100° Point of the Saccharimeter; Values of Clerget Divisors; Conductometric Determination of the Ash Content of Sugar Products; Error due to the Volume of the Lead Precipitate; Determination of Reducing Sugars; Refining and Keeping Qualities of Cane and Beet Sugars; Standardization of Quartz Control Plates; Refractometric Estimation of Water in Sugars; Colorimetry; Testing of Molasses; Determination of Raffinose; Marc Volume Estimation for Digestion Process; Determination of SO_2 in Refined Sugars.

Brevities.

BRAZIL.—A British Consular Report on Economic Conditions in Brazil observes that the revolution of 1930 marked an important epoch in the economic and social life of Brazil, and in this respect must be regarded as the major event of the year's history. The revolution itself was accomplished with a minimum of disturbance and was based on a demand for a drastic change of policy in general and a thorough-going reconstruction of the economic life of the country.—Of late British trade has suffered less as a result of the general depression in Brazil than that of its principal competitors—an indication of the relative stability and soundness of the British export movement.

---

pH CONTROL.—An indicator having a range as wide as 1·0 to 11·0 is recommended by the makers of the well-known Hellige comparator, the apparatus with non-fading, reliable glass standards mounted in unbreakable discs. It is claimed that the colours for the various *pH* values are capable of being so clearly differentiated that an accuracy of 0·1 *pH* can be guaranteed between 4·0 and 9·4 *pH*, and 0·25 beyond the ends of this intermediate range. This wide range indicator is, therefore, not merely useful for rapidly finding the approximate *pH* value of an unknown solution, but also for very accurate general hydrogen-ion control determinations.

ICING SUGAR PLANT.—The new "Sectional" Disintegrator for the production of fine icing sugar is a development of the Woodburn apparatus, which is well-known. Sugar is fed to the grinding chamber by a worm, where the crystals are broken by impact with beaters revolving at about 3000 revs. per min. Thence the fine sugar is drawn by a fan and delivered into the cyclone, the air from which is returned to the machine. The standard size of apparatus has a capacity of 10 cwts. per hour. Fifty of these improved sugar Disintegrators are said to be at work in the U.K. and overseas and to be giving excellent results.

PRESSED LOAF PROCESS.—Conical loaf sugar is still in demand in Europe and in some Eastern countries. A good deal of ingenuity has been directed towards evolving an efficient process for producing this type of refined sugar by pressing in place of the old moulding and stoving process, which indeed is still generally used. This aim is said to be realized by the Melin patented machine, which turns out 300 conical loaves per hour with the labour of two boys. It does away with the numberless moulds, as well as the trucks, centrifugals, shaping machines and other accessory apparatus of the old method. Considerable space is economized, and, not least, operations are carried out at a normal temperature.

BOILER FEED-WATER.—In a recently published book[1] the rôle of colloids in the treatment of boiler-water is discussed. This method depends upon the concentration of the scale-forming material upon the colloidal matter, so that a scale cannot be formed, only a sludge. It is essential that the colloid be stable at the temperature of the boiler. An apparatus known as the "Filtrator," which is very largely used, employs linseed from which a suitable colloid is extracted by steam. Only 1 lb. of linseed is required per 2000 gall. of water treated, and it is claimed that this will prevent the accumulation of scale beyond 1/32 in. thickness. A great number of "Filtrator" plants are in use in different countries. Even with very hard waters very good results are obtained, practically all the scale-forming salts being thrown down as a sludge, which is blown down from time to time.

BRITISH AND U.S. ECONOMIC POSITIONS CONTRASTED.—According to the *Times*, Sir Arthur Balfour, a prominent business man who has just returned to England from the New World, expresses the opinion that provided the Canadians can liquidate their wheat position without much loss, there is no reason why Canada's economic recovery should not be fairly rapid. On the other hand in the United States, he found the economic position worse than he or any living American had ever known it. If one had to choose between the economic position of America to-day and that of Great Britain, one would undoubtedly choose the latter because, although we have many troubles, our foundations are much more secure and we are much nearer the economic facts than are the manufacturers of the United States. Under their high tariffs the latter when they are unable to sell the bulk of their production at home at favourable prices find that export trade becomes impossible for them.

---

1 "The Chemical Technology of Steam-Raising Plant." Henry Norman Bassett. (Edward Arnold, London). 1931. Price: 12s. 6d.

Review of Current Technical Literature.[1]

Bagasse Furnaces. C. E. Stone. *Reports of the Association of Hawaiian Sugar Technologists,* 1930.

In the latter part of 1928 at the Waialua Agricultural Company, a new Sterling boiler was installed of 790 rated H.P. Its furnace was of the step-ladder grate type with "Chico" flat arch construction, consisting of one firebox with two sets of grates, a division wall between the grates, and tuyeres all around the sides and back. It had approximately 2-2½ cub. ft. of furnace volume per rated B.H.P. On the older type furnace in Hawaii, one very seldom has over 1 cub. ft. of furnace volume per rated boiler horse-power, and sometimes much less. This could be carried up to 4 or 5 cub.ft. with much success. With the furnaces too small the flame strikes the heating surfaces, this resulting in the combined action of cooling and keeping the volatile and other combustible gases below their kindling temperature. Under these conditions not enough time and space are provided for the proper mixing of the volatile and the oxygen necessary to burn them ; besides which, with a good draft much fine bagasse is carried over into the combustion chamber and back connexions. Naturally this causes a lot of work and expense in cleaning at week-ends, and in some furnaces causes hard, glass-like slag to form on the furnace walls and combustion chamber floors. At Waialua, an arch was built the full width of the furnace so that all the bagasse would have to fall on to the step grates. The boiler can be operated with the ash cleaning doors closed, most of the air coming into the furnace through the tuyeres only, except for a slight leakage at the cleaning doors. The bridge wall was carried up to within 24 ins. of the flat arch. An average furnace temperature of 2300 to 2400°F. is obtained (1700 being about the maximum temperature attainable with the old type), and the temperature of the escaping gases at the stack is about 530° ; the draft at the stack is 0·9 in. ; CO_2 readings averaged about 16 per cent., showing fairly good work.

Boilers of to-day have reached a state where there is little chance of greater economy in absorbing the heat efficiently, so that the efficient generation of steam really becomes an efficient generation of heat in the furnace. To this end suitable apparatus should be installed for the determination and checking of combustion results. In mills not so equipped, the possible savings due to intelligent use of such apparatus in reducing preventible losses, are enormous. Therefore the installation of accurate and reliable draft gauges, temperature recorders and CO_2 instruments should be given serious study in even the smallest mills. To make changes in the furnace design in Hawaiian old-type boiler furnaces, it would be necessary to either raise the boiler or lower the floor, but in most cases, the increased capacity and efficiency obtained from these changes will more than compensate for the expenditure involved. General requirements of proper combustion in the bagasse furnace may be summarized as follows : (1) Even feeding of the bagasse the full width of the furnace. (2) Admission of an air supply in such a way that a sufficient amount of oxygen will be supplied for proper combustion, the air to be admitted at the proper time and in such a manner that the oxygen of the air comes into free contact with the burning fuel and gases. (3) That the furnace temperature be maintained as high as possible from the standpoint of commercial efficiency, i.e., not high enough to burn out the brickwork. (4) That a provision be made for the expansion of the gases during the period of their combustion preferably with larger combustion volume. It would seem perhaps a simple matter to effect proper combustion. Such is not the case however, as it is the physical and mechanical conditions encountered that render the problem of proper combustion difficult.

White Sugar Manufacture with Whole Juice Filtration, at San Pablo, Tucuman. J. E. Normand. *Proceedings of the Fourth Annual Conference of the Association of Sugar Technologists of Cuba,* 1930.[2]

A sulphitation process (for which it is stated a patent has been taken out by Edouard Hirsch) involving the filtration of the whole juice is described : Juice

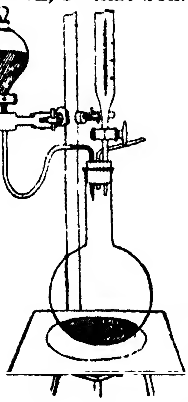
[1] This Review is copyright, and no part of it may be reproduced without permission. Editors *I.S.J.*

[2] As to the connexion with Tucuman, the reader is referred to a criticism by Dr. W. E. Cross on p. 308

leaving the mills is pumped to a Quarez installation, where the SO_2 is injected by aspiration, not by compression. Sulphitation increases its acidity from 0·05 — 0·08 per cent. (as CaO) to 0·14, 40 grms. of sulphur per 100 kg. of cane being required for this. It follows into three lime mixers (system Maguin), where it is also measured, following which it is limed nearly to neutrality, using milk at 11°Bé. added in a continuous stream as it runs into the liming tank, about 150 grms. of lime per 100 kg. of cane being required. After mixing for quarter of an hour, at the end of which operation it should show a faint acid reaction to litmus, it goes to the tubular juice heaters where it is raised to 98-102°C., next arriving at the separator. This apparatus is divided into two compartments united at the bottom by a syphon, the steam escaping freely from the second compartment, while the juice flows directly to the filter presses. Sometimes it is decanted after a rest of two hours, and only the muddy portion amounting to 25 per cent. of the whole filtered. When, however, it is filtered, as is general, it has a fine appearance, and yields a plantation white of the best quality, the second and third products after remelting and carefully filtering giving pilé of 99·95° polarization with 0·02 per cent. of moisture. This so-called Hirsch process is recommended for white sugar production in Cuba, the equipment that would be added to the average raw factory of 100,000 bags capacity (325 lbs. per bag) costing about $35,000. Advantages claimed are that it is rapid, simple, and economical of labour and steam. Defecators are eliminated. Juice is perfectly decolorized, and its purity appreciably increased. Great importance is attached to the juice being maintained at a high temperature throughout during all operations, and protected from contact with the air, filtration being thus facilitated, and substances precipitated at a high temperature not being given opportunity to dissolve. (Syrup clarification is not mentioned.)

VOLUMETRIC DETERMINATION OF REDUCING SUGARS BY FEHLING'S SOLUTION, FOLLOWING A MODIFICATION OF LANE AND EYNON'S METHOD. **A. R. Ling and W. A. Carter.** *The Analyst*, 1930, **55**, No. 657, 730-734.

In this modification of LANE and EYNON's method[1] the authors recommend new conditions, viz., the use of : (1) a closed flask, in which an atmosphere of steam is maintained during the titration; (2) the addition of successive small volumes (e.g., 0·5 c.c. at a short interval of time) of assay solution to the boiling FEHLING's solution, so that boiling is continuous throughout the titration ; and (3) the length of time occupied by the titration must be more than 10 minutes. They carry out the titration in a boiling flask (200 c.c.) shown in the illustration fitted with a trebly bored cork or rubber stopper, previously boiled with distilled water; the jet of the burette is passed through one hole, a tube connected with a reservoir of 1 per cent. methylene blue solution through a second, and an open tube bent at a right angle through the third. Boiling is carried out on wire gauze covered with asbestos. In the experiments described, the invert sugar solutions had a concentration of 0·2 grm. per 100 c.c.; and the volume of FEHLING's solution was the same in all cases, viz., 10 c.c. In all the tests recorded, five drops of 1 per cent. methylene blue solution were added just before reduction was complete. It is important that the same amount should always be used, since this indicator acts in virtue of the fact that it is reduced to the leuco-base by the sugar solution.



It is evident from the results described that the titration should occupy about 15 min. This can be secured by adding to the boiling FEHLING's solution successive quantities of 0·5 c.c. of assay liquid every 15 secs. In this way the liquid may be maintained in gentle ebullition throughout the experiment. This method of titrating solutions of invert sugar with FEHLING's solution yields more concordant results,

[1] *I.S.J.*, 1923, 143-149.

and gives a higher value for the reducing power of invert sugar, than any other volumetric method previously described. This applies to the method described by LANE and EYNON,[1] although they made a great advance in suggesting the use of methylene blue as indicator. Not only are the results obtained by this modification more concordant than when LANE and EYNON's method is employed; but, in addition, there is the distinct advantage that no preliminary titration is necessary, the first titration being as accurate as the succeeding ones. Thus the method is more expeditious than any other known to the authors. As regards concordance of results, the agreement between separate titrations is not so close with EYNON and LANE's method as with the new modification now described. The difference is due principally to the fact that in the latter the bulk of the assay solution is added to the FEHLING's solution in the cold, and that the time of boiling is too short. However, the accuracy of the two methods does not differ seriously. Thus when FEHLING's solution has been standardized by the method described by LANE and EYNON, and the assay carried out in the same manner, the results would generally be close to the truth.

EFFECT OF AMINO-ACIDS ON THE ROTATION OF GLUCOSE AND FRUCTOSE, AND ITS SIGNIFICANCE TO THE DETERMINATION OF SUCROSE BY THE DOUBLE POLARIZATION METHOD. **D. T. Englis and F. A. Dykins.** *Ind. & Eng. Chem.*, 1931, **3**, No. 1, 17-21. In the double polarization method, the *pH* of the solution may be very markedly increased by both the excess of de-leading reagent and the soluble acetate salt produced in the lead precipitation process. This may be expected to favour the amino-acid-acidol sugar combination to an extent depending on different factors, as quantities, time and temperature. Even if the solution be neutralized, the rate of reversion is slow. Thus the apparent change due to the hydrolysis of the sucrose can vary widely and be either higher or lower than the original value. Differences between the results obtained by the double polarization and the gravimetric methods probably result from these effects. Satisfactory results by the double polarization method must involve very careful consideration of the tendency of amino-acids and glucose to combine, as well as the many factors which previously have received attention.—TURBIDITY SPECTROPHOTOMETER. **R. T. Balch.** *Ind. and Eng. Chemi.* (*Analytical Edition*), 1931, **3**, No. 2, 124-127. Transmission of light at a definite wave-length is taken as a measure of turbidity, and colour is compensated by using as a standard a portion of the same sugar solution from which suspended solids have been removed by filtration through paper with the aid of a slow-filtering grade of kieselguhr (standard "FilterCel"). This method is believed to have interesting possibilities, though the apparatus required is at present expensive. A simple single-wave apparatus might be designed.—IMPURITIES IN WHITE SUGARS: DETERMINATION OF PHOSPHORUS. **S. Byall and J. A. Ambler.** *Industrial and Engineering Chemistry* (*Analytical Edition*), 1931, **3**, No. 2, 136-137. BRIGGS' modification of the Bell-Doisey coerulo-molybdate method of determining phosphates is sufficiently delicate to indicate the small amounts of inorganic phosphorus and by difference the amounts of organic phosphorus present in sugars, being capable of showing as little as 0·3 parts per million of P_2O_5 applied to a 10 grm. sample. Direct consumption beet sugars showed 0·3-1·4 and 2·9-45·6; direct consumption cane sugars, 0·9-3·7 and 0·3-18·7; and refined cane sugars 0-0·6 and 0·6-9·2 p.p.m. of inorganic and organic P_2O_5 respectively. The occurrence of such large proportions of organic phosphorus in refined cane sugars is unexpected.—RAPID DETERMINATION OF TRUE PURITY USING THE CONDUCTIVITY DEPRESSION METHOD. **J. H. Zisch.** *Facts about Sugar*, 1931, **26**, No. 3, 128. An error occurred in the author's description of his new method,[2] where the following instruction regarding the concentration of the HCl which is added previous to determining the resistance is given: "(25 ml. of 6 per cent. HCl made up to 1000 ml.)" This, however, should have read: "(25 ml. of 36 per cent. HCl made up to 1000 ml.)" A concentration of acid as low as 6 per cent. would lead to unsuccessful results in applying this method.

J. P. O.

[1] *Loc. Cit.* [2] *I.S.J.*, 1931, 89.

United States Atlantic Ports.

(Willett & Gray).

(Total of 2,240 lbs.)	1931 Tons.	1930 Tons.
Total Receipts, Jan. 1st to May 23rd	1,023,180	1,105,256
Deliveries ,, ,, ,,	1,028,103	1,306,736
Meltings by Refiners ,, ,,	953,488	1,183,470
Exports of Refined ,, ,,	16,500	16,700
Importers' Stocks, May 23rd	153,969	235,791
Total Stocks, ,,	314,360	518,651
	1930	1929
Total Consumption for twelve months	5,599,377	5,810,980

Cuba.

RECEIPTS, EXPORTS AND STOCK AT MAY 23RD.

(Willett & Gray).

	1931 Tons	1930 Tons.
Production to date	3,115,000	4,550,000
Less Cuban Consumption to date	54,000	36,366
	3,061,000	4,513,634
Stock at Shipping Ports	996,969	1,698,582
Total Exports	372,811	945,997
Total Receipts at Shipping Ports	1,369,780	2,644,579
Stock on Plantations and in transit to Ports	1,691,220	1,869,055

Sugar Crops of the World.

(Willett & Gray's Estimates to May 28th, 1931.)

	1930-31. Tons.	1929-30. Tons.	1928-29. Tons.
CANE.			
America	7,672,904	9,410,934	9,430,470
Asia	7,883,434	7,368,766	7,274,922
Australasia	622,477	626,239	633,066
Africa	796,316	747,491	748,468
Europe	14,000	13,562	11,610
Total Cane	16,989,131	18,166,992	18,098,536
BEET.			
Europe	10,281,986	8,219,148	8,469,491
U.S.A.	1,075,688	901,713	938,640
Canada	40,953	27,869	28,857
Total Beet	11,398,627	9,148,730	9,436,988
TOTAL CANE AND BEET	28,387,758	27,315,722	27,535,524

Sugar Market Report.

Our last report was dated 11th May, 1931.

During the period under review markets have been quiet and at one time very depressed, especially in America where sellers predominated and prices at one moment fell to within about ten points of the lowest prices recorded last September. European markets have been more stable.

No further news has been received regarding the Chadbourne plan, but it is understood that Mr. CHADBOURNE who is now in America is trying to arrange for a single seller for Cuban sugar and also to bring Philippines and Porto Ricos more in touch with the whole scheme.

There is very little change to report in the London Terminal Market since a month ago, but another 14,000 tons were tendered on May, making the total tenders for this month about 34,000 tons. May finally finished up at 6s., August moved from 6s. 4d. to 5s. 11¾d., and recovered again to 6s. 4d. December was heavily traded in and fell to 6s. 2¼d., but has recovered to 6s. 7d., March moved from 6s. 10½d. to 6s. 5d. to 6s. 9d. and May from 7s. 0½d. to 6s. 7d. to 6s. 11d. The latest prices are, August 6s. 4d., December 6s. 7d., March 6s. 9d. and May 6s. 11d.

Trading in refined sugar was very quiet for the first portion of the period under review, but last week considerable purchases were made by the trade both from the Home Grown and also British Refiners. The Refiners reduced their prices 3d. per cwt. on the 26th May, but as a big demand sprang up they advanced them 3d. on the 29th May and a further 3d. on the 1st June, their latest prices being, Tate's No. 1 Cubes 24s. 3d., London Granulated 20s. 10½d.

Business in Raws to the Refiners has been fairly active and transactions have been taking place daily from 6s. 4d. to 6s. to 6s. 3d. c.i.f. for Cubans, San Domingos and Perus, and at one moment a parcel of Perus were sold at 5s. 10½d. Preferential sugars were sold at 10s. c.i.f. 88 per cent. Beet has been sold from time to time at the same parity.

The American market is still under the influence of sellers of Porto Rico and Philippines, but it is thought now that these sales are coming to an end, and from now onwards America will be more dependent on Cuban sugar. At one moment in New York, c.i.f. sugar was sold at 1·11. The latest price is 1·25, and it is reported that there are buyers at this figure.

No further sales of Russian sugar have been reported, but it is understood that Russia has bought 10,000 tons of German Crystals ; and they were in the market for further quantities but finance stood in the way of pulling this contract off.

F. O. LICHT has issued a third estimate of the European Beet sowings, but did not make any change in his second estimate, although in some quarters it is considered that for certain countries he is too high.

21, Mincing Lane,
London, E.C.3.
8th June, 1931.

ARTHUR B. HODGE,
Sugar Merchants and Brokers.

THE

INTERNATIONAL
SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 391. JULY, 1931. VOL. XXXIII.

Notes and Comments.

The Outlook.

No marked change has taken place during the past four weeks in the position of sugar in the market. There has merely been a hardening of confidence; but it has been necessary to emphasize that a Five-year plan which was devised to avoid any drastic upheaval of the sugar market would not in the nature of things produce a rapid revival, especially during the first year when stocks, even apart from the segregated quantities, are ample and time is required to leaven the lump. Unless the psychological factor comes into play sooner and more effectively than at the moment seems likely, it is quite on the cards that another six months may elapse before the upward trend of sugar prices really gets going. The segregation of sugar has been but the preliminary stage in correcting the adverse balance between supply and demand; it has achieved something if it has prevented the market descending to yet deeper levels of depression. The next step is to await the effects of the reduced crops being grown this year, especially those in Europe; also, the effect of the arrangement that sugars not disposed of to the market this year cannot be carried over into 1932, but must form part of the quotas of that year. If the general world trade depression is assuaged by the end of the year, sugar consumption may be expected to resume its gradual expansion, and a return to its normal average increase would have a stimulating effect on the balance between demand and supply. What may prove the biggest lift to that world depression has been supplied by the proposal of President HOOVER to suspend for a year the international debt interest payments. America has through its President at last voiced the view that the drain of gold to her bank coffers at the expense of debtor countries in Europe is of no benefit to American trade. What England pays to the United States in war debt interests is largely obtained from European debtors, especially the ex-enemy countries, and the strain of making those payments annually has now brought Germany to the verge of bankruptcy. The effect on the markets of President HOOVER's proposals has been so striking that it seems unlikely that these will be allowed to fall through, even though it is not proving an easy task to reconcile all the divergent interests, those of France in particular. If the scheme succeeds, it seems not unlikely that sugar will be one of the first commodities to reap the benefit, because sugar has already laid the foundations of its new house.

The International Sugar Council met in London on June 22nd, and took stock of the achievements. Very little has been evinced as to what was discussed, but F. O. LICHT summarizes a number of *on dits* that have appeared in the press, and one may assume that there is some foundation for most of them. Negotiations with Peru and San Domingo for entering the pact are alleged to be in an advanced stage of agreement. Further negotiations have been conducted with Russia, and it is at least noticeable that this country has not as yet been reported as closing the door to some agreement or other. The chief remaining menace in fact comes from the Philippines, who have seemingly so little faith in the future that they have adopted a policy of jettisoning on the market not only their 1931 but also their 1932 crops. If Chadbourne's agreement is to succeed early and well, it seems incumbent on that financier to devise means to stop the leaks in the scheme, so one has the more reason for hoping that the next few months will see the accomplishment of convincing the Philippine sugar interests that it will pay them better to fall into line with the rest of the sugar world.

Inconclusive Statistics.

Most of the statistical tables covering the present production of sugar appear to be drawn up as though to illustrate the position that would have ruled if the Chadbourne pact had not been signed ; and the marked influence that segregation is about to play is insufficiently demonstrated. Mr. GOLODETZ in a recent issue of his Market Review makes the following relevant remarks on the point :—

" Statistical data regarding supplies are usually given, where countries participating in the Chadbourne Pact are concerned, without any qualification being made as to what part of the supplies is segregated and withdrawn from the market during the current crop year. Thus, for instance, Cuba's total stock at all points of the Island is given in the position for the 6th June as 3,610,565 tons, as against 3,521,032 tons a year ago, thus showing an excess of 89,000 tons. A mental note has to be made of the 1,035,000 tons which have to be carried over compulsorily into the next crop year in comparison with the 1,300,000 tons segregated last year in the island. When 1,035,000 tons are deducted from the Cuban stocks, the remaining 2,575,565 tons, free for export in the current year, are seen to represent one million tons less than last year. The same is true, although to a much lesser degree, of the figure of stocks for the European countries involved in the Chadbourne agreement. The total for Czecho-slovakia, Belgium, Poland and Germany at the 1st of June is given as 2,410,500 tons, compared with 1,718,300 tons on the same day a year ago. This means an excess of 692,200 tons. The position undergoes a considerable change when the combined volume of sugars segregated in the four European countries, amounting to about 1,000,000 tons, is deducted from the stocks, thus reducing them to 1,410,500 tons. They will then show a decrease of about 300,000 tons compared with last year."

Progress in Beet Sugar Production in England.

The entry of the British sugar beet industry into the third and last stage of the subsidy granted it has been considered an appropriate occasion to review its progress, and the Ministry of Agriculture and Fisheries has just issued, at the price of 6d., a pamphlet of nearly 300 pages giving the results of investigations that have lasted for some months.[1]

[1] The work is noticed elsewhere under "Publications Received."

Amongst the conclusions arrived at are that this country is eminently suitable for sugar beet cultivation; there have been successful growers of the crop in every county in England and Wales, and in some counties in the south of Scotland. The sugar content has been found to compare favourably with what is obtained abroad, while the white sugar made has been of high quality and has obtained satisfactory prices in competition with sugar refined from imported raws. The agricultural advantages of growing beet in rotation with other crops have been amply demonstrated : the crop has helped to maintain arable cultivation in those districts where it is largely grown, while the production of feeding stuffs from the bye-products is tending, as abroad, to maintain if not to increase the stock-carrying capacity of arable farms.

The technical progress of the farmer and the field worker during the subsidy period is deemed satisfactory ; but the average yield of beet per acre throughout the country does not as yet compare favourably with foreign results, being from 1½ to 2½ tons less on the average. Root weights have remained approximately unchanged during the subsidy period, but compare favourably with weights obtained abroad. As for the factories, it is considered on the available evidence that their standard of technical efficiency now approximates to that of foreign usines. The last few seasons the factories have been helped by their ability to work to full capacity ; indeed in 1930 the throughput considerably exceeded the rated capacity as a result of abundant beet supplies and efficient transport arrangements. A factor that helps is the ability of the factories to extend their manufacturing season about a month longer than the average season abroad, due to the longer autumn and later frosts ruling. Manufacturing costs have been reduced by about 40 per cent. between 1924-5 and 1929-30, largely owing to the full capacity being more nearly attained.

Factory development has been at a standstill for several years and though there are districts—notably the south and west of England—without any factories, the forthcoming reduction of the subsidy and the present low level of sugar prices do not increase the chances of further factories being built. The low price of sugar at present ruling precludes any country in the world from maintaining a sugar beet industry on a profitable basis unless supported by substantial artificial aid. Much depends, then, on the scale of prices existing in 1934 when the subsidy is due to expire as to whether the British beet sugar industry can continue unaided, or alternatively stand in need of a continuing subsidy *sine die*, the justification for which would necessarily have to lie in the general agricultural advantages accruing. But, as the authors of this interesting review deem it, the British sugar beet industry should be able to prove by 1934 that, judged by its standards of accomplishment and by the structure and virility of its organizations, it has been fully worthy of public support.

The Position in the West Indies.

What is happening to West Indian sugar factories in these days of uneconomic prices for sugar is amply illustrated by the experience of the Caroni factory in Trinidad for the year 1930. This factory is probably as efficient as any in the British West Indies and the policy of the Board has been to keep it right up to date and to add such modern improvements as would give immediate results in reduced costs of production. But the low price the sugar fetched was too much of a handicap, and a loss for the year of £11,265 was recorded on an output of 9600 tons of sugars. This output was, however,

below the average, that of 1929 having been 12,338 tons and that of 1931 being put at 13,600 tons, the Company's highest on record.

At the annual meeting, Mr. J. G. MILLER, the chairman, expressed the opinion that the International Sugar Convention was an honest, sincere and desirable plan to meet the necessity for the restoration of market confidence and the securing of a living wage to a hard-pressed world industry. It well deserved success and seemed likely indeed to be the forerunner of similar international agreements for other staple commodities where production is far in excess of present requirements. That the Convention was needed is evident from the position in Cuba where, he said, receivers have this year been appointed for a good many estates and the losses in sugar production have been colossal. As for the British West Indies, it must be obvious to the veriest novice that their sugar estates could have fared no better in the world's sugar market and would have been wiped out ere this, but for the preference accorded to their sugar both in the United Kingdom and in Canada.

Mr. MILLER took the opportunity in the course of his speech to mention a factor that, while well known to those concerned with running a sugar factory and estate, is not as apparent as it should be to those in high quarters who dictate fiscal policy or the granting of loans. He referred to the fact that sugar cane growers are bound to budget for heavy expenditure ahead, on Capital account for improvements in machinery and on Crop account in preparing the land, ploughing, planting, cultivating, reaping and grinding, before a penny piece can be realized from the actual product. Hence any restriction in credit has an effect not only on the immediate crop but on future crops as well.

The Falkiner Cane Harvester.

The invention of cane harvesting machines seems to find its home in Australia. There the wide level tracts of canefield lend themselves specially to mechanical appliance, and since the Australian wage level is about the highest in any cane growing region of the world, the incentive to devise labour-saving machinery is all the greater. Three types of harvester have originated in Queensland—the Falkiner, the Howard, and the Miller-Owen. The first named is however the only one that so far can claim to have reached a stage of commercial utility. The other two are still in the experimental stage, but both are said to show much promise. These have so far only been tried in Australia ; but the Falkiner after graduating, so to speak, in that country has since been tried out in Cuba, and more recently still in Florida, where from the latest accounts the machine is proving a success.

Mr. R. S. FALKINER, the inventor of the machine, is not, strange to say, a sugar planter but a leading Australian sheep breeder, whose hobby has lain in devising and patenting models of various types of labour-saving machinery. Twenty years ago a Queensland farmer drew his attention to the need for a cane harvesting machine, and Mr. FALKINER first financed the farmer's own experiments, and then when the latter died, Mr. FALKINER with the assistance of an engineer in his employ embarked on the task of solving the problem for himself. The first successful Australian machine was produced in 1925, when the task of cutting and topping straight cane on a level field with the trash burnt off was successfully accomplished. A film of this machine in operation was shown to the Havana Conference of Sugar Technologists in 1927 and it led to the Punta Alegre Sugar Company importing a machine for trial on its estates in Cuba. This machine, designed to operate on level fields

growing straight cane, was found not to be suitable for the conditions met with in Cuba, viz., highly ridged and roughly cultivated land, with the cane often growing in a tangled mass with frequent large areas recumbent or blown down by the heavy winds. However, the Punta Alegre authorities were so convinced of the principle of the machine being right that they invited Mr. FALKINER to remain and endeavour to overcome the difficulties. After about a year of experimenting with different modifications the present " Fender " or " Push-over " type was evolved, which is claimed to accomplish successfully the process of cutting, trashing, topping, and loading in one operation. Briefly described, as the machine passes along the cane furrows the standing cane is pushed over by the fender, the sprawling or fallen cane is straightened up forward by suitable arms and pick-up fingers preparatory to being taken into the throat of the advancing machine. Revolving knives at the ground level cut the stool of cane at the root, and the cane and trash are drawn into the machine by a set of double elevators and chopped into small bits. The whole mass is fed into a chaffing device and then subjected to a powerful air suction arrangement which separates the cane from the trash. The clean cane is then ejected into box carts in which it is conveyed to the mill. The machine is worked and propelled by a 100 H.P. motor ; but the air suction is worked by a separate motor running at constant speed.

Following on the successful trials of the new machine in Cuba, a number of machines have been ordered and tried out in the level cane lands of Florida. We hope in the next issue to give a brief account of the results there achieved.

Refining in Australia.

The Half-Annual Report of the Colonial Sugar Refining Co., the big Australian sugar refiners, shows that during the six months ended 31st March last the profits amounted to £384,097 (on a capital of £5,850,000) ; dividend and bonus absorb £365,625 and adding the amount carried forward from the previous half year, the credit of Profit and Loss account stands at £394,062. This carry forward slightly exceeds the profits earned and continues the policy which the Company has pursued for some forty years past of leaving in the business more or less of the profits earned during the previous half-year.

Mr. E. W. KNOX, the chairman, in his survey of recent happenings in the Australian sugar industry, said that increasing unemployment had been a factor in depressing the sugar market. In previous periods of financial difficulty in Australia the consumption of sugar was not reduced ; but since the present troubles developed, there had been a continuing shortage in deliveries of sugar, amounting to 8 per cent. for the half year. The recent decision of the Federal Government not to alter the selling price of sugar for another three years has been the result of the official enquiry which has lasted for some months. The C.S.R. Co. submitted evidence to show the whole of its transactions in Australia and the profits made in relation to the sugar used ; and both the Majority and Minority Reports agreed that the profits made by the Company were not excessive in view of the services rendered, the magnitude of the business handled, and the money required to finance it. As for the future, the shadow of increasing taxation looms large and is already a serious drain on all companies in Australia, not least on the C.S.R. Co. But the financial strength of the company is such that no immediate drop in the rate of dividend seems likely. It has stood at 12½ per cent. for some time past.

International Society of Sugar Cane Technologists.

Porto Rico Congress.

The date of the Congress has been fixed for March 1st to 16th, 1932, by the Executive Committee of the Association of Porto Rico. The municipality of San Juan will extend a welcome on the evening of the 1st, and the official opening of the Conference has been set for Wednesday morning, March 2nd. A General and Business Meeting will be held on March 3rd, and Sectional Meetings are scheduled for the mornings of March 4th, 5th, 6th and 8th. March 9th has been set aside for the final General Meeting. The Insular Experiment Station at Rio Piedras will entertain the visitors on March 10th. The Congress will conclude with a farewell dinner on March 16th.

The arrangements for the Congress have been placed in the hands of three committees, the chairmen of which, together with MANUEL A. DEL VALLE, Local Secretary of the Society, Central Constancia, Toa Baja, Porto Rico, form the General Committee in charge of preparations. Machinery firms and other companies manufacturing equipment and supplies are manifesting keen interest in the exhibits planned for the Congress.

Titles and brief summaries of papers to be offered should also be mailed promptly to Mr. DEL VALLE, the manuscripts of all papers and of the reports of Standing Committees should reach him by October 1st to have copies ready for distribution at the Congress.

Membership.—Since the publication of the last news letter, the membership has increased from 286 to 415. Sections are now established in 17 geographical divisions, and there is one member each in three others.

Technical Committees.—The Association of Sugar Technologists of Cuba has appointed a new committee to co-operate with the Special Committee on Uniformity in Reporting Factory Data of this Society. It consists of J. M. SANTOS, Chairman, LEE G. CAMP, A. P. FOWLER, H. D. LANIER, and E. L. SYMES. The Association of Hawaiian Sugar Technologists has adopted a number of the international definitions in the new 1931 edition of its "Book of Methods."

Cane Variety Collections.—W. W. G. MOIR (Hawaii), Chairman of the Section on Varieties at the Soerabaja Conference, has called our attention to the fact that it should have been mentioned that the Java Experiment Station already has in its possession the most comprehensive collection of cane varieties in existence.

As the Society has expressed the desire that there should be at least two collections of this character, and as so far only the collection being established in Porto Rico by the U.S. Department of Agriculture answers that requirement, the Java Experiment Station has again been approached with the suggestion that it secure the necessary permission to make its collection available to investigators for comparative studies of cane varieties, or to furnish plant material with which another collection may be established in the Pacific area.

INTERNATIONAL SUGAR COUNCIL.—The first official communiqué of the International Sugar Council, following on its meeting in London on June 22nd, states that there was a full representation of the Cuban, Java, Czechoslovak, German, Polish, Hungarian and Belgian Associations. The Council confirmed the permanent organization of its headquarters at the Hague. There was considerable discussion as to the methods to be adopted in further extension and development of the Chadbourne Plan. It was the unanimous opinion that what had already been done was along sound lines and to the lasting benefit of the sugar industry. The next meeting of the Council will be held in Paris on September 14th.

Short Cropping in Hawaii.[1]

The following explanation of the meaning of the term "Short Cropping" forms the introduction to a paper by G. Chambers, read at the 1930 Meeting of the Hawaiian Sugar Planters' Association :—Cycles of cane growth vary greatly in different countries, e.g., from 12 months in Java, Porto Rico and Louisiana (one crop a year), to 24 months which at one time was almost the standard practice in Hawaii (one crop in two years). During recent years there has, however, been in the latter country a distinct tendency to reduce this long period of growth by short cropping, the ideal aimed at being a cycle of 18 months, or two crops in three years. For this to be effected, it has been found necessary, in any area, to reap certain fields in successive years (though not at the same time of year) and then at an interval of two years (not again at the same time of year). Fields reaped in successive years are termed "short ratoons" and when the reaping years are not successive "intermediate" or "long short ratoons." The terms long short and short do not necessarily imply any difference in the age at reaping ; when a field is run continuously on a two-crop-in-three-years cycle the age factor is often eliminated, as is illustrated by a chart of a field on Kekaha estate in Kauai, which was run on this crop cycle from 1908 to 1926, with six short and seven long short ratoons From this chart it appears that the short ratoons in general started their growth between January and April and were harvested between August and November in the next year, with an average of 18 months' growth : the long short ratoons, which immediately succeeded them, started their growth as soon as they were cut, that is, between August and November and were harvested in February to March in the year but one following, with an average of 18 months' growth. The whole field was thus run on a cycle of two crops in three years, one set covering two summers and the other two winters in their growth. Data are then produced to show that, as a group, Hawaiian plantations are scaling down their average cane age from the 23 or 24 month schedule. Extracts from the annual reports of 16 plantations, from 1926 to 1929, show that the total short cropping area increased by 7728 acres, the total area cropped by 7098 acres, and the percentage of short cropping increased from 15·9 to 27·0.

The ultimate aim of all changes in methods being to increase the profits, the author set himself the task of finding out if this tendency towards short cropping was producing the results anticipated. And for this purpose he consulted representative managers in Hawaii, Maui, Kauai and Oahu. The answers are printed in full, together with a long report on "The crop programme at Ewa" in Oahu. The correspondents in general appear not to be very confident as yet on the ultimate success of short cropping; but the fact that the practice is steadily spreading, and nothing very serious is urged against it seems to indicate that it is on the whole considered desirable. There are, however, many factors which have to be considered, and the conditions regarding these factors vary a good deal in different regions, e.g., as to climate, water requirements, irrigation, labour facilities and varieties grown. The clearest statement in favour of the practice appears to be that coming from Waimanalo in Oahu, and some of the details given by the manager are reproduced here.

On this estate short cropping was intended as an offset to a critical shortage of water during the summer months, which, we take it, is a not uncommon state of affairs in Hawaii, where the rainy season is in the winter

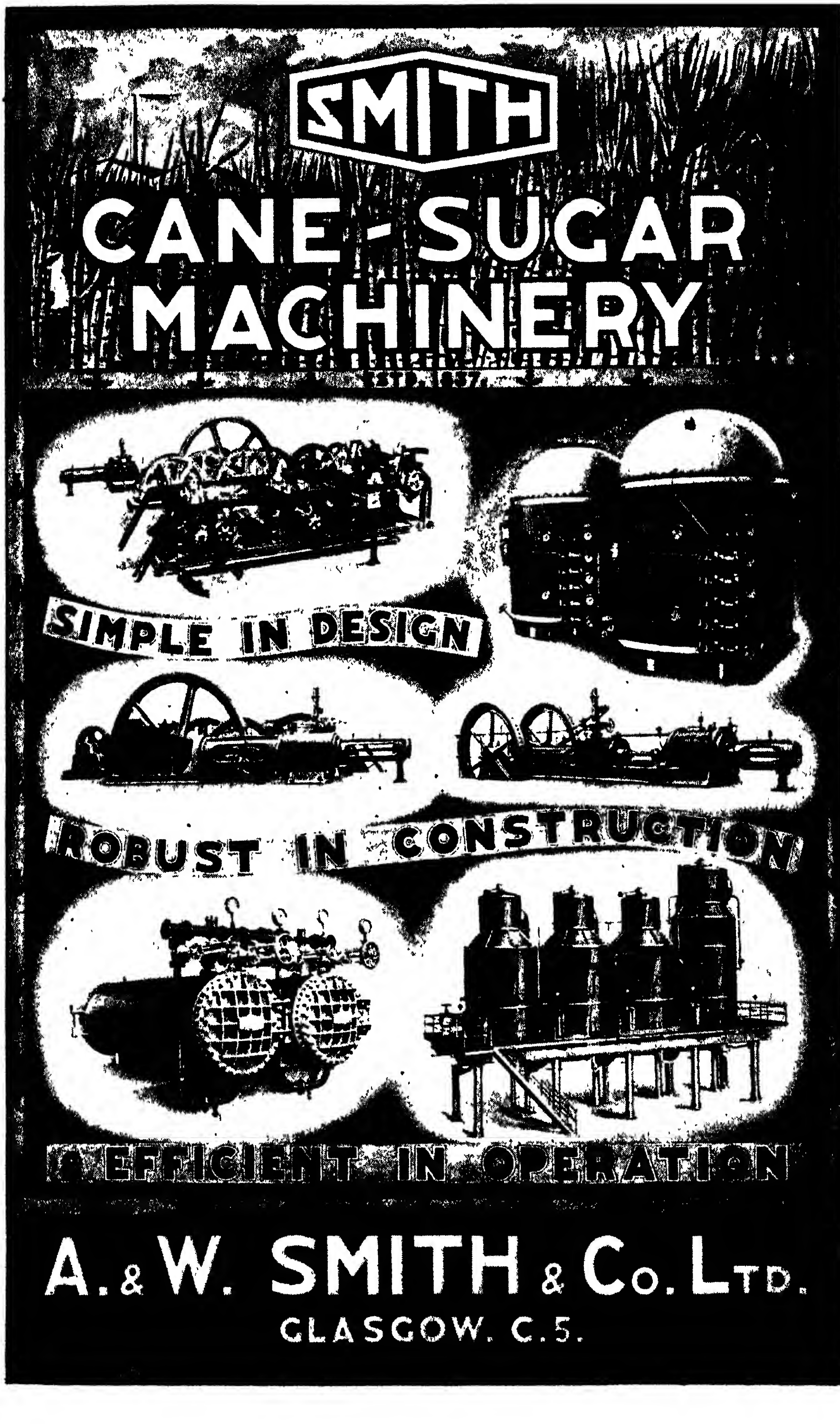
[1] Short Cropping with relation to Yield and Cost. G. Chambers. 50th Annual Meeting of the Hawaiian Sugar Planters' Association, 1930.

and not in the summer as is most usual in tropical countries. By harvesting certain fields in August, September and even in October (which we note as usual in short cropping), it was found to be possible to cut down the area needing irrigation during the months June, July and August, when water is very scarce. This arrangement is now being further revised by stopping the grinding once or twice during the season, and using these stops for cleaning the fields, as a labour expedient. The extent of the change is seen in a Table giving the percentage of short cropping on the estate during the past five years, which runs as follows: 13·5, 11·9, 30·6, 28·7, 30·7 respectively. Another Table gives the averages of sugar production and costs for the four years ending 1929, for long ratoons (averaging 22·10 months), long short ratoons (19·50), and short ratoons (19·30). Summarizing, the two types of short ratoons produced more sugar per acre at a less cost that the long ratoons. But a note somewhat clouds the issue, for it adds that these figures are not strictly comparable, because the short cropped area is the best land, from which more profits would be naturally expected under Waimanalo conditions.

As regards *water requirements* which are the limiting factor, a theoretical approach is made, which is intended to show the benefits which are being obtained in actual practice. A comparison is instituted between equal field areas under a long ratoon cycle and one of short ratoons with intermittent harvesting as described, or an intermittent short cropping cycle. A couple of graphs show the average requirements of water during the dry months, June, July, August and September for these two cycles: summarizing, standard two year cropping fields require 1880 million gallons during the four dry months while intermittent short cropped fields only need 1600 million gallons; thereby saving 280 million gallons, which would irrigate an additional 350 acres, twice a month, during these same dry months.

Labour considerations.—Short cropping has resulted in a lengthening of the harvesting season and, with occasional stops during the grinding season, the fields are kept much cleaner without great fluctuations in labour requirements. At no time is there a scarcity of work for the men. This is illustrated by another graph showing the peaks of labour required in standard short and intermittent short cropping: the peak period is very much longer with the latter, but not nearly so high. Under these conditions, and assuming that the peak requirements must be maintained (and the maximum number of labourers permanently employed), only 300 men would be necessary with intermittent, as against 400 with standard short cropping cycles: this would work out at a saving of 100 men per day, 2600 men per month and 31,200 men per year, or 25 per cent. of the pay roll. Lastly, as regards varieties of cane grown, the manager writes "with the spreading of new varieties such as POJ 36 and 2878, and possibly the Ubas, it is quite likely that the sugar producing characteristics of these canes may permit, even oblige us, to increase our short crop ratoon area even further. The future must decide." He summarizes the main benefits derived from short cropping as follows: "1. A better distribution of water—so that peak requirements do not take place in the summer months when water is scarce. 2. A better distribution of labour through lengthening the crop. This is especially true when intermittent harvesting is used in combination with short cropping, which reduces the total men required. (3) A better utilization of land by reducing the idle acre months."

In conclusion he asks himself whether short cropping increases yields and profits, and answers that a comparison of results (such as are given in the


SMITH
CANE-SUGAR
MACHINERY
SIMPLE IN DESIGN
ROBUST IN CONSTRUCTION
EFFICIENT IN OPERATION
A. & W. SMITH & Co. Ltd.
GLASGOW. C.5.

Tables) from long and short ratoons does not give the answer, for the main benefit of short cropping is often reflected in the so-called long ratoons (which for instance receive the water saved). It is therefore necessary to consider the system as a whole. A gain in yield must eventually increase the average sugar per acre per month of all cycles combined. Such a gain has taken place during recent years, but it is not known how much of this may be due to varieties and other factors. " Opinions, however, seem united, that short cropping up to a certain point (which point varies with climatic and soil conditions) has resulted in greater yields and increased profits to the industry."

C. A. B.

Scientific Work in the Hawaiian Cane Fields.

The Reports of the Hawaiian Sugar Planters' Association for the last two years, containing approximately 100 pages each, are as usual packed with interesting matter.

Pests and Diseases.—It appears to be the custom in Hawaii for all the plantations to be inspected each year, and the following summary represents the present position as regards pests and diseases in them. The hunt in foreign countries for parasitic enemies of the pests in the cane fields, which laid the foundations of scientific work in the fields in Hawaii and has always continued to be a major project, shows no sign of flagging. The activity in this work at present lies in the Far East, PEMBERTON working in Malaya and other countries and HADDEN in the Philippines, with a general programme including all natural enemies of the Anomala and Adorotus beetles (called white grub elsewhere), cane borers, pink mealybug, grasshoppers and mosquitoes. It is customary in these Reports to commence with a brief review of the existing status of those pests which have caused trouble in the past and have been more or less successfully controlled by this means, at the same time noting any new facts which have come to light concerning them.

The leaf hopper, which many years ago was the first enemy attacked by the Association, has been satisfactorily controlled, only one outbreak having occurred during the period under review, which was quickly overcome. The cane moth borer, effectually controlled by a tachinid brought from New Guinea years ago, still gives occasional trouble, especially where rats have damaged the canes ; and PEMBERTON is not sanguine of being able to find any more effective parasite. Relief is rather looked for in shorter cropping and the introduction of resistant varieties. It is noted that POJ 36, which appears to be rapidly spreading, is resistant to the beetle borer, just as it is to the moth borer in other countries. Anomala showed a disturbing outbreak at Ewa, but on examination there it was found to be strongly parasitized with the introduced *Scolia manilae* ; an intensive study of the situation is being made by the Entomologists. There were a few outbreaks of army worms, but their control by parasites is very efficient. The nut-grass borer, obtained from the Philippines in 1925, appeared to be doing sufficiently good work, in places, to dispense with the usual hoeing ; but it has been attacked by an egg parasite which may interfere with its hoped for usefulness. With regard to Adoretus, further introduction of parasites has been unsuccessful. The Horn fly has not been materially reduced by the introduction of its enemy the dung beetle, but the latter is becoming well established. Grasshoppers continue

[1] For the years ending September 30th, 1929, and September 30th, 1930.

to give trouble, and parasites are being sought for. The nematode survey of the plantations has now been completed. *Tylenchus similis* is the most abundant, but is less in evidence at higher elevations. The peak as to numbers occurs in canes from 12-16 months' growth and then declines. Yellow Caledonia is the most attacked, then H 109 and D 1135, and Yellow Tip least; and there are comparatively few nematodes in saline soils. ZAULUWENBURG, in reviewing the work, says that he has met with no evidence that their attacking the roots causes a recognizable growth failure by themselves. Monochus, a form feeding on other nematodes, has received marked attention and an intensive study of it has been commenced. And a handbook is being prepared on the natural fauna of the cane fields in Hawaii, including both insect and other invertebrate forms attacking the cane plant, which should prove of great interest in all cane growing countries. Lastly, a carnivorous mosquito, not blood sucking but feeding on the larvae of other mosquitoes, was introduced by PEMBERTON in 1929 from New Guinea. This was successfully reared and multiplied and promised to be a useful addition to the local cane fauna; but they are not at home as to their special requirements in breeding pools, and new carnivorous forms are being looked for to take their place. From all of which it appears that the control of cane pests by introduced parasites in Hawaii has become very efficient, but that nothing is being left to chance: the accumulated experience of many years is not being allowed to lapse, and the weapon thus forged is being kept in order and its efficiency maintained and increased.

A New Rat Poison.—Rats in the cane fields have in the past received a great deal of attention in Hawaii; and, after much money was spent in trapping and killing them, the use of barium carbonate or strychnine was found to be cheaper and more effective. A new substance has now been discovered which is said to be, in low concentrations, much more toxic than the barium carbonate, namely thallium sulphate. And NAQUIN's method of rendering the barium carbonate and strychnine baits water-proof has also been successfully applied to this new rat poison.

Cane Diseases.—With the exception of growth failure, eye spot, and mosaic, no appreciable losses are reported as having occurred, and the details appended will show how free the Hawaiian plantations are from fungus diseases. Several cases of growth failure were noted on H 109, but on examination this variety was found to be strongly resistant to the attacks of Pythium on its roots, and the cases of growth failure noted were put down to some physiological cause. In an experiment, however, the disease was induced by growing it in soil mixed with 50 to 75 per cent. of cattle manure. The entry of the fungus hyphae into the root was observed to be by pressure, through the actively extending cells behind the growing point. CARPENTER, as a result of his studies on root failure or root disease in Hawaii, divides them into two classes: (*a*) caused by Pythium, which attacks all varieties, and susceptible ones severely and (*b*) caused by faulty soil conditions over restricted areas. Eye spot was found to be of less extent than previously, and this was put down to the planting of resistant varieties and following other recommendations of the Pathologist curtailment of summer and fall nitrogen manuring is needed on fields likely to be affected. In mosaic, the areas subject to it are being gradually reduced, chiefly by the use of resistant varieties and the selection of healthy planting material. POJ 36 is said to be highly resistant to mosaic in Hawaii, so that little trouble is anticipated because of the spread of this variety. Roguing fields with light infection is strongly recommended.

Other diseases mentioned are brown stripe and pokkah boeng. The former was regarded as threatening in 1928, but disappeared later. It is now being studied from the plant nutrition point of view ; and canes affected by it have been found to be deficient in silica. Pokkah boeng occurred in a few localities without causing commercial losses. Its appearance in POJ 2878 during 1929 caused some concern, but this trouble disappeared in the following year. The *Fusarium moniliforme*, which is associated with this disease in Java, has not been found as yet in Hawaii, but other strains of Fusarium have been isolated which, after inoculation, have induced the symptoms of pokkah boeng.

Cane breeding.—During 1928-1929, 80,000 seedlings were transplanted to the fields. In this work four lines of descent were followed, those of Kassoer, Uba, Indian thin canes, and ordinary tropical canes : 800 trial crosses were made with these, of which 160 produced 50 or more seedlings for transplanting in the fields. The bulk of these seedlings were raised at Makiki, and both fuzz and flats with young seedlings were transmitted also to Maui, and Hilo in the island of Hawaii. In the following year about 70,000 seedlings were raised, 56,860 in Oahu (chiefly at Kailua sub-station), 4417 on Maui, and 8240 on Hawaii.

But besides this local work, in the latter year an interesting development took place which raised the cane breeding work again to a project of major importance, in which all sections of the Experiment Station took a part, namely in raising seedlings from fuzz imported from other parts of the world. This new departure appears to have been due to experiences gained during the visits of officers of the department to Java and other countries, in the previous year while attending the meeting of the International Society of Sugar Cane Technologists in that island. The Director and cane breeding officers of the Hawaiian Planters' Association were presumably impressed by the regular growing of the fuzz in Java, for breeding work in Formosa. One section of the Report under review is here repeated.

" Through the kindness of the Sugar cane breeding Station at Coimbatore, India, U. K. Das, of this department, was provided with facilities for making crosses between a number of hardy Indian varieties growing at Coimbatore. The crossed tassels, when ripe, were packed in sealed tins containing calcium chloride and carbon dioxide, and were brought by Mr. Das to Honolulu. Upon its arrival here the material was turned over to the Quarantine Committee, and planted in Kanoa Quarantine House No. 2 on Molokai under the supervision of the pathologists. Good germinations were obtained and some 1200 of the resulting canes are now growing in the quarantine house. This lot of canes includes the blood of a number of India's hardiest varieties and should prove a valuable addition to our collection of breeding material."

Similar projects were arranged for work in Australia and New Guinea during the year, under different officers. As a result, more than enough germinations were obtained of Australian crosses to fill the house to capacity, and 400 germinations of the newly described species, *Saccharum robustum*, from New Guinea. To accommodate these seedlings special arrangements had been made at the quarantine station on Molokai island ; additional land was acquired and a large greenhouse was erected on it for dealing with seedlings raised from imported fuzz. Meantime, a new device has been designed for threshing cane seed from its fuzz, " so that it may be operated within a closed case, from the opening of the original package to the threshing and the disinfection of the threshed product. The device was used for both the Indian and Australian importations of this year."

Coupled with this new development, quarantine regulations at Molokai island have been overhauled and tightened up, so as to include the seedlings raised from imported fuzz. although cane seed is not known to carry any diseases. The Kailua variety station in Oahu offers 80 to 90 acres for growing breeding canes and for the preliminary testing of newly propagated seedlings. The more promising are sent on from Kailua to five regional or zonal stations distributed over the islands, representing conditions peculiar to large blocks of plantation lands ; and after a second testing are distributed to the individual plantations of the region for final growth and selection. It is estimated that with this arrangement 100,000 seedlings, entering their preliminary testing at Kailua, will furnish 1000 varieties to each regional variety station, and ultimately about 10 to each plantation for the usual course of field tests. "Thus the seedlings which go to the plantations will be of good grade and the experience of the past, wherein plantation areas have been given over to seedlings of indifferent promise, will be avoided."

Among the Notes on Seedlings the following descriptions of the behaviour of POJ 2878 and POJ 36 under Hawaiian conditions appear to be of special interest. These are short and are reproduced in full. "POJ 2878 holds the centre of attention in all districts. While it is too early as yet to be convinced of its superiority over any of our standard varieties it must be admitted that this cane is definitely in the running under practically all conditions. It is rather unimpressive at the start and seems to find its stride only after three or four months. It is more resistant to eye spot than H 109. The majority of the favourable reports thus far have been coming from H 109 districts. Its future seems somewhat less certain in the Caledonia, D 1135 and Tip regions, but most of the comments from these districts, if uncertain, are at least hopeful. Some plantations have already spread this variety to 25 acres or more, and the majority have installed final tests in comparison with the present standard varieties.

"POJ 36 is now firmly established as one of our standard varieties, and will probably occupy well over 10,000 acres by the end of the present planting season. It is becoming obvious, however, that it cannot compete with Tip or UD 1 under extreme mauka conditions. It continues to show up well as a cane for eye spot areas on Oahu and Kauai. It is being rapidly extended also in the D 1135 zones of Hawaii. There has been some complaint about difficulty and expense of harvesting due to its hardness. Its resistance to rat and borer injury, however, probably more than offsets the additional harvesting costs. Its rapid closing in and excellent weed control make it a more profitable cane than the present varieties in weedy situations, even at the same sugar yield."

A full list is given, by the Director, of foreign varieties imported during the years from 1923 to 1930—altogether 45 varieties, including *Saccharum robustum* from New Britain. In 1930 seed was also obtained of *Erianthus arundinaceum* from Java, from which 10 seedlings were raised, and seed of *Saccharum robustum* from New Guinea from which 444 seedlings were raised. A detailed list is also given of the crossings effected in India and Australia, with the numbers of seedlings raised from each cross : 24 crosses were effected in India and 44 in Australia.

Molasses as a soil amendment.—Scattered through these two Reports are references to the effect of molasses on Hawaiian soils, especially where growth failure has been noted in H 109. Thus LYMAN reports that in such failures a tremendous stimulus was given by applications of 20 to 40 tons per acre, preferably before ploughing. In a small test with 20 tons of molasses the

rise in sugar obtained was as much as 56 per cent. ; and in a second test with 40 tons, not yet completed, an outstanding growth of canes is taking place. This was apparently on very porous gravelly soil, and it is recorded that it has yet to be determined whether the stimulus will continue through the ratoon crops.

The residual effect of molasses was observed on another plantation. Soil samples were examined where molasses had been applied at 20 to 40 tons per acre, and in a cane field where a very large application (probably about 100 tons) had been made 6 years before. All of these fields showed a residual effect, most definitely in the amount of potash, but also to a small extent in phosphoric acid. As the phosphorus content of molasses is very small, it was presumed that its increase was due to the secondary effect of the carbohydrate of the molasses on the soil bacteria. These observations seem to indicate that the residual effect may last for a considerable time.

A special study was instituted during 1929, when A. F. HECK joined the department in order " to investigate the biological possibilities and associated problems connected with researches in molasses as a soil amendment." He soon found that in a gravelly soil, under laboratory conditions, molasses added at the rate of 10 tons to the acre was rapidly decomposed, practically all the sugar disappearing within 24 hours. This was accompanied by a large increase in soil organisms and a definite rise in temperature ; and only one quarter of the carbon in the sugar re-appeared in the carbonic acid gas given off, the rest apparently being locked up in the micro-organism material. In other experiments HECK found that the sugar disappeared in three days, and about one-half of the carbon contained appeared as carbonic acid. This is important in the local field practice, for if the rate of decomposition is the same, it would be reasonable to suppose that one half molasses carbon will be found in the micro-organisms, and that " reactions inimical to plant growth will have ceased within a week." Previously, no detailed information had been obtained regarding the increase in soil organisms, and it was usually considered that about five weeks should elapse after the application of molasses before planting could commence : and this although application of 30 tons of molasses per acre had been successfully applied to young canes on a large scale through the irrigation water.

HECK points out that a nitrogen relationship exists in the decomposition of molasses in the soil : " If sodium nitrate is present in sufficient quantities forty pounds of nitrate nitrogen is removed from the soil and apparently built up into this micro-organic material for every ton of molasses decomposed." He has found indications that this nitrate nitrogen is used by the soil micro-organisms and that it becomes organic proteins in their cellular tissue. He further points out that no loss is occasioned by this change in the form of the nitrogen. in that it is locked up in the micro-organisms and will be available for the plant at a later stage of growth. As an interesting commentary on these ideas, it is observed that in the experiments of the department with " molash-cake " in 1927, an addition of nitrogen and phosphate was made as an " activator," to hasten the decomposition of this substance, and as a protection of the plant against denitrification, which was observed soon after its application, especially if no activator was used

" HECK also found that yeast formation is stimulated by molasses applications to the soil. And since, as he observes, the more fertile a soil may be the more active biologically it will be found, there can be little doubt as to the beneficial rôle which molasses plays."

C. A. B.

Remarks on the Determination of the Sugar Content of Cane.[1]

By P. NEUVILLE, Sucrerie d'Ermant, Egypt.

In the majority of cane sugar factories, the sugar entering into process is arrived at after the mills, that is, by taking the sum of the polarizations of the mixed juice and of the bagasse. Leaving out of consideration the difficulty of determining the weight of the mixed juice and of the bagasse, the figure thus obtained is too low, the loss of sucrose taking place in the milling installation not being taken into account.

Nor is the sugar found by means of the Java ratio exact either, as it includes systematic and important errors. Only the sugar content directly determined by the analysis of a large number of samples of cane is capable of giving an exact result. In fact, the sugar content of the cane differs from the polarization of the mixed juice plus that of the bagasse by all the losses that have taken place during extraction, as well as by the difference between the apparent polarization and the true sucrose.

The losses taking place during milling are considerable and are probably caused in major part by micro-organisms, the enormous rate of development of which has again recently been pointed out by Miss A. P. NEEB,[2] F. E. RAABE[3] having previously drawn attention to the presence in sound cane of micro-organisms capable of decomposing sucrose. An every-day observation demonstrates the rapid fermentation of juice in the presence of bagasse: Take a sample of bagasse from the 2nd mill, soak it with weak juice, and after mixing well divide it into two portions; re-press the first immediately, and the other after an hour's exposure to the air at the temperature of the mill-house. One will thus observe a notable fall of purity in the two juices obtained.

Moreover, the time of fermentation of molasses wash is reduced by two-thirds when it takes place in the presence of bagasse.[4] Then, particularly in the case of the last mills, with thin-juice and bagasse in presence of one another the decomposition of the sucrose must take place more rapidly than is suspected. The difference of purity between the primary juice and the mixed juice indicates a destruction of sugar during milling. In the case of the diffusion of bagasse, on leaving the 2nd mill the bagasse is returned with its juice properly limed to a diffuser. It is brought to about 100°C., and in this way is sterilized.

The diffusion juice thus obtained has the same purity as the primary juice. In the Nobel process, which can be considered as an intermediate process between milling and diffusion, the fall of purity between the primary juice and the mixed juice is lower than in milling. According to the work of several Java technologists, in particular of EGETER and KHAINOVSKY, the hot aqueous digestion of bagasse does not cause optically-active substances to go into solution.

If, therefore, there is no fall of purity between the diffusion juice and the primary juice the fall of purity existing between the mixed juice of the mills and the primary juice must arise from a destruction of polarization. *A priori* condemnation of the method of indirectly determining the sucrose content

---

1 Paper presented to the International Society of Cane Sugar Technologists, and here published by permission of the Society.

2 *Archief*, 1930, 38, No. 5, 92-109; *I.S.J.*, 1930, 252.

3 *Archief*, Verslagen, 1929, Afl. 2, 38-39.

4 WM. L. OWEN and WM. P. DENSON. *The Planter*, 1928, 61-64, 83-85, 102-105. *I.S.J.*, 1928, 157.

of the cane from the sum of the polarizations of the mixed juice and of the bagasse is thus confirmed by numerous facts.

The figure obtained by the Java ratio, called the coefficient in Egypt, that is to say : $\frac{\text{Sucrose per cent. cane} \times 100}{\text{Polarization of primary juice,}}$ cannot be exact, as it depends on false premises, as we shall show. In Egypt the cane worked by the factories is almost exclusively POJ 105 ; its sugar content is 12 to 13 per cent., its fibre about 11 per cent., the apparent purity of its primary juice about 80°, and its reducing-sugars-sucrose ratio about 7.

In the diffusion factories the primary juice comes from two mills of about 2000 × 900 mm. (80 × 36 in.). In the milling factories the primary juice comes from a Krajewski crusher, about 2000 × 500 mm. (80 × 20 in.), and a mill, about 2000 × 900 mm. (80 × 36 in.). The extraction corresponding to the primary juice in the two types of extraction plants is 60 to 65 per cent. As these factories are situated in a part of Egypt where it never rains, the necessity of employing a special coefficient analogous to the Natal ratio does not exist. The coefficient is determined in the following way twice a year in each factory, using a sample of canes taken from the carrier :—

A determined weight of canes is crushed in a hand-mill, 125 × 130 mm. (about 5 × 5⅛ in.) a sufficient number of times to obtain an extraction figure similar to that obtained in the factory. Juice and bagasse are weighed, and the sum of their weights should be equal within 1 per cent. of the cane taken, which loss of weight is considered as being a loss of juice. The polarization per 100 grms. of juice is determined from the Brix and the polarization per 100 c.c. ; the polarization per 100 grms. of bagasse is determined by the hot aqueous digestion method (Zameron) ; these polarizations enable one to calculate the polarization per cent. cane. By this method one arrives at coefficients varying from 80 to 90, their average at the end of the season having been 82 to 86 during the past few years. Milling factories have obtained a coefficient a little lower than that found by the diffusion factories.

During the whole of the last season, one of the milling factories having arranged in its laboratory a two-unit mill of 350 × 250 mm. (13¾ × 9¾ in.) carried out the direct polarization of its cane. A daily average of 132 samples of cane of 25 kg. each was taken from the trucks by hand while discharging, and sent to the laboratory. Sampling therefore consisted of 3400 kg. of cane for a daily average of 3·119 tons. Ten samples at a time, that is 250 kg. of the cane with its trash were crushed in the said two mills. The juice collected was strained, weighed, and immediately analysed, the bagasse being weighed and analysed by the Zameron method. The weight of the juice and of the bagasse totalled that of the weight of the cane taken within 0·7 per cent., which difference was assumed to be earth and trash. At the end of the campaign the polarization per cent. cane thus determined was 12·82 per cent. in place of 12·17 per cent. by the method previously indicated using the coefficient. The polarization per 100 grms. of juice from the small mills was 15·33 in place of 14·94 found in the factory.

Observing at the beginning of the season large differences between these polarizations per 100 grms. of juice, we believed the relatively low extraction figure for the small mills of 47 per cent. against 60 to 65 per cent. of the large mills to be the reason, which we tried to verify by a series of experiments.

We collected the juice of a sample of cane which had passed once through the two laboratory mills, the bagasse obtained being sent a second time

through the two mills, giving a second juice, which was mixed with the first. The average of six experiments gave the following figures :—

First extraction .... 47·80 of juice per cent. cane ;
16·98 pol. per 100 grms. juice.

First and second extractions 62·20 of juice per cent. cane ;
16·94 pol. per 100 grms. juice.

From which one sees that an increase in the extraction figure diminishes by only a few tenths of a per cent. the pol. per 100 grms. of the juice obtained from these mills. Hence the polarization of the juice obtained by crushing is thus different in small mills from what it is in large ones.

Another series of tests enabled us to observe almost identical juice polarizations with small as with large mills. The calculation of the coefficient based on the juice obtained by small mills cannot therefore be applied to the primary juice of the factory mills. If the coefficient calculated from small mills is : $\frac{100 \times 12{\cdot}82}{15{\cdot}33} = 83{\cdot}6$, this applied to the primary juice of the factory gives a sugar content of $83{\cdot}6 \times 14{\cdot}94 = 12{\cdot}49$, which is 0·33 lower than reality. The coefficient should be $\frac{100 \times 12{\cdot}82}{14{\cdot}94} = 85{\cdot}8$.

Another cause of error in the sugar content obtained by the coefficient, or by the direct determination of the sugar content, or by the sum of the polarizations of the mixed juice and of the bagasse, is the difference between the sucrose and polarization of the juice. The sucrose per cent. of the juice being always superior to the polarization per cent. of the juice, this error always lowers the true value of the coefficent. This makes the coefficient rise from 85·8 to 87·4 per cent.

For several years past in the two factories of the Société Générale des Sucreries et de la Raffinerie d'Egypte employing bagasse diffusion, the sucrose of the sugar put into bags and weighed, of the molasses weighed, and the polarization of the bagasse, the quantity of which is calculated from the fibre, give a sum which does not correspond to the sugar content of the cane as calculated by the coefficient. One of the factories has obtained an average coefficient during the last campaign of 85·2 and the other one of 85·8, whereas in order to balance the sucrose going out and the polarization a coefficient of 86·5 for the first and one of 85·0 for the second factory would be required.

It is therefore necessary to assume for the coefficient a value higher than 87. If a coefficient as high be applied to the primary juice of the milling factories of the same company the undetermined losses are found to be very high, in spite of no appreciable loss being observed by analysis or mechanically.

We intend again to take up next season the direct determination of the sugar content of the cane while increasing the number of samples analysed. Here, however, we underline the most important economic conclusion, which anyone can immediately arrive at, namely the following : That the sugar content of the cane worked cannot be established from the mixed juice and the bagasse ; that the sugar content as found from the Java ratio is hardly more exact ; that the corrected Java ratio taking into account the systematic error that is attached to it, however, gives a sugar content less false than the preceding ; and that only the direct determination of the sugar content of the cane is capable of giving a figure approaching the truth, it being of course understood that the necessary conditions for sampling and good analysis are fulfilled.

Assucar Amorpho.

By NORMAN E. LAMONT.

While the largest portion of the sugars produced by the usinas of Brazil is either plantation white or 96° refining grade (so-called Demeraras), the most common type to be found on the tables of the consumer is called *assucar amorpho*. This is a soft white, or off-white product, which is damp in varying degrees. It is the favourite of all classes, and a good proportion of it is made in the kitchens of the people simply by concentrating a syrup to which white-of-egg has usually been added, removing the scum from time to time, and, when the desired " point " or density (arrived at by the experience of the operator, or by the ball test) has been reached, mixing and beating till the whole mass crystallizes out, and the last traces of water are removed. Then the dampish sugar is either spread out to dry, or is sifted to dryness.

On the technical scale in the refinery the processes are in principle the same. The clarified syrup is boiled very rapidly at atmospheric pressure, using the relatively large heating surface of an open *tacho*. On the " point " being reached, the contents of the pot are tipped out into a *batadeira* or circular metal vessel fitted with rapidly revolving vertical stirrers ; then, when the sugar is in the necessary half-dry condition, it is precipitated through a trap-door upon a conveyor, along which it travels still giving off water by self-evaporation. On reaching the end of its travels, it falls upon a series of oscillating horizontal sifters, which separate the lumps, the fine-grained, dry, warm sugar being bagged off, and the lumps returned to the *batadeira* to accelerate the graining operation there.

Success in these operations all depends on the good quality of the sugar melted, the rule being the lower the glucose ratio, the better the quality of the final product, quality here denoting the freeness and dryness of the sugar apart from its colour. A melt of a high glucose and acidity content means a sticky, non-drying, off-colour type of amorphous sugar. Even with a neutral melt, glucose will of course be formed during the manufacture, the amount depending on the time spent under steam at atmospheric pressure.

A rigid control at the melters must therefore be maintained by the addition of milk-of-lime so as to ensure a filtered syrup of slightly alkaline reaction, say 7·2 *pH*. Melts showing a *pH* of 6·2 or thereabouts require so much lime that even at neutral point the syrup is yellowish. After graining, such yellow syrups may be treated with hydrosulphite, though this nostrum unfortunately "goes off" during the subsequent storage of the sugar. Since most carbons decrease in decolorizing power proportionately, roughly, as the *pH* increases, the abnormal quantity of carbon required would make the process too expensive.

As a rule, therefore, either washed Demeraras or plantation whites that are dry, and low in glucose and in acidity are used. Rapid boiling with a constant steam pressure is practised, and the beating and sifting operations are carried out at high speed. Cooling before bagging as far as possible is a measure towards turning out an amorphous sugar of good keeping quality. Depending on the efficiency of the manufacturing processes in general, the product may contain 97 to 98·5 per cent. of sucrose and from 0·5 to 2·5 per cent. of glucose, even when one commences with a melt of 99° purity. Besides that occurring during clarification and bleaching, there is no elimination of impurities, and the secret of obtaining a yield of 100 per cent. (or somewhat over, depending on the moisture content of the finished product) lies in using the proper sugar for melting.

Teatini's Juice Purification Process.

Prof. M. TEATINI, Manager of two Belgian beet sugar factories, has put into operation at Hougaerde and elsewhere a process for the clarification of raw juice, which has aroused much attention. It was recently described in detail in these columns.[1]

Briefly it consists of the following steps : The raw juice is limed to raise its *pH* from 5·5-6·5 up to about 12·0-12·1, the lime thus added being 0·05-0·10 per cent. of the roots ; liquid SO_2 at the rate of 100-125 grms. per ton of roots, or 0·01 per cent. of the roots, is introduced so as to lower the *pH* to the iso-electric point, round about 11·95-12·1 *pH*, at which point the maximum flocculation of the colloids is secured ; more lime is added, this time about 0·45-0·80 per cent. ; carbonatation follows, after which the procedure is as usual.

Advantages claimed are *inter alia* : a large reduction in the lime ; improved purification ; reduced sugar losses ; much decreased coke, coal and cloth charges ; and an increase in the capacity of the factory. The value of this new process (patents for which have been applied for) has been the subject of a careful investigation by Dr. O. SPENGLER and ST. BÖTTGER,[2] of the Institute for Sugar Industry, Berlin, and a summary of their experiments and conclusions is given below.

LABORATORY INVESTIGATIONS.

Experiments in the laboratory were so planned as to work exactly according to the Teatini Process (Series *A*) ; to divide the dose of lime as in the T.P., but without using any SO_2 (Series *B*) ; to follow the normal procedure (Series *C*) ; and lastly to use the same amount of lime as in Series *A* and *B*, but adding it all at once (Series *D*). Below are the results of these comparative experiments :

TABLE I.

CaO Addition. Per cent.		Series *A*. Teatini.	Series *B*. Teatini without SO_2	Series *C*. As usual using 1·8 per cent. CaO.	Series D. CaO as *A* and *B* but undivided.
0·4 + 0·45	*Q*	91·2	91·3	93·6	90·3
	F	12·4	12·4	8·5	13·2
0·4 + 0·50	*Q*	91·4	91·6	93·7	90·5
	F	12·2	12·5	8·7	13·3
0·4 + 0·60	*Q*	92·0	92·0	93·7	91·3
	F	11·3	11·6	8·7	13·0
0·4 + 0·70	*Q*	93·0	92·9	93·6	92·6
	F	11·8	11·9	8·2	12·2
0·4 + 0·80	*Q*	93·4	93·5	93·7	92·9
	F	10·8	10·9	8·6	11·3

Q = true purity. *F* = colour in Stammer degrees per 100° Brix.

It is seen from these figures that the small addition of lime in Series *A*, *B*, and *D* has prevented the satisfactory colour elimination that has taken place in Series *C*, in which the dose approached the normal amount. Further that there is practically no difference between the results of Series *A* and *B*, i.e., with and without SO_2. Hence the SO_2 exerted no decolorizing effect. On the other hand, the normal process (Series *C*) using 1·8 per cent. of CaO, showed a better purification, and considerably more colour elimination. In Series *D*, however, in which the small dose of lime as used by Teatini was added altogether, the results are much less satisfactory, the purity being higher, and the colour elimination lower.

It is also seen from the table above that if one works as in the Teatini method (Series *A*), but with a greater amount of lime, viz., 1·1 per cent., there

[1] *I.S.J.*, 1930, 370. [2] *Zeitsch. Ver. deut. Zuckerind.*, 1931, 81, 233.

is, as one would expect, an increase in the purity, and a decrease in the colour, so that the results approach those obtained by the normal process. But even with 1·2 per cent. of lime the Teatini method compares unfavourably with ordinary working. These tests have also proved that the division of the dose of lime is advantageous as compared with addition at one time, as is seen in the figures for Series *B* and *D*. (In the original article graphs are shown, which make these points especially clear).

Small Scale Trials.

Trials were made in the small experimental factory of the Institute, and these were planned on the same lines, viz., Series *A*, after Teatini (0·4 per cent. CaO on the roots, plus SO_2, plus 0·8 per cent. CaO); Series *B*, the same divided additions of lime, but no SO_2; Series *C*, the usual carbonatation process using 2 per cent. CaO; and Series *D*, also the usual process, but with 1·2 per cent. CaO, added in one dose. Table II shows some massecuite results, these being average figures for the factory tests :—

Table II.

	Series *A* Teatini, 0.4 + 0.8 CaO.		Series *B* 0.4 + 0.8 CaO ; no SO_2		Series *C* Usual Method, 2 per cent. CaO		Series *D* 1.2 per cent. CaO ; in one dose.	
True Purity	93·0	93·2	93·4	93·0	93·2	93·1	92·5	92·0
Colour, 100 Brix	21·1	21·7	21·5	21·1	18·1	17·7	34·0	36·8
Ash, 100° Brix.	2·219	2·346	2·165	2·323	2·116	2·378	2·414	2·486

Press work, sweetening-off the scums, evaporation, and boiling proceeded smoothly, except with the juices produced according to Series *D*. It can thus be concluded that a moderately good purification of raw juice can be effected by half the usual amount of lime, added in one or more than one preliminary dose to raise the alkalinity to the iso-electric point (given by Teatini as around 12 *pH*), this being followed by the final addition.

Anyway, as far as can be concluded from these experiments, the small addition of SO_2 specified in the Teatini process is of no significance, as can be seen by comparing the results of Series *A* and *B*. From the figures of Series *A*, *B* and *C*, one notices that the same purity and approximately the same ash contents were found, but that the colour of both massecuites and washed sugars in Series *A* and *B* were inferior to those of the normal process, shown in Series *C*. Then especially striking are the figures for the tests in which the dose of lime was divided (Series *B*), as compared with addition at one time (Series *D*), the latter showing very much more colour.

Therefore juices with high colour content were always obtained with the Teatini process. Further, it must be possible to work with even less lime without employing the Teatini process, and at the same time obtain juices considerably better than in that process. Instead of using SO_2, about 10-20 per cent. of acid raw juice was injected into pre-defecated juice at 12 *pH*, afterwards working as is prescribed in the Teatini process; thick-juices, massecuites and sugars were obtained corresponding exactly with those obtained in parallel tests made by the Teatini process.

It has been made clear that dividing the dose of lime improves the purification, and that the more the lime used in this way, the more the colour removed. Yet better results in respect of colour elimination can be obtained with very little lime if after a slight addition of lime and a short pre-defecation the flocculate be removed from the juice, to which afterwards a little more lime is added. In this way, with only 0·7 per cent. of total lime, massecuites and sugars were produced at least equal in true purity, colour and ash content

with those made according to the ordinary carbonatation process employing 2 per cent. of lime on the roots.

FACTORY TRIALS.

These laboratory and small scale trials have been confirmed in every respect by experiences in several German factories. Thus, it was observed that the outstanding quality of the raw sugar made in the *X* sugar factory suddenly showed a striking deterioration in respect of its affinability during a period of a few days, when the Teatini process was being worked. In another factory, *Y*, which likewise had instituted comparative experiments with the Teatini and the ordinary methods, the fall in quality was yet greater, when employing the former. The normal sugar of this factory had a type value of 6, perhaps even of 7 ; but at the moment at which the Teatini process was introduced its quality sank to 4·5-5·0, and sometime to 4·2. After discontinuing the Teatini process, the superior quality of the sugar was at once restored.

In the Offstein factory, where we worked several days with Prof. TEATINI and Mr. SCHUMACHER, it was seen that between the normal juice and that made according to the Teatini process quite a great difference existed. This was confirmed by Prof. TEATINI. In fact the Teatini clarified juice was almost as dark as the normal thick-juice; and the good quality of the standard Offstein sugar strikingly fell off during the working of the Teatini juice purification process. As a matter of fact, the beautiful Offstein white sugar deteriorated to a *melis* quality.

Although the results given by the Teatini process were not favourable, we are nevertheless of the opinion that the study of this process should still be continued. We ought to thank Mr. SCHUMACHER, who has declared that he is ready to authorize the use of the Teatini process at Offstein factory during the next campaign and to carry out the tests for a further period.

Filtrability and Refinability of Raw Sugar.[1]

By C. F. BARDORF and J. A. B. BALL.

The selective adsorption of substances by boneblack or animal charcoal has been investigated in many directions, and some characteristics established. It is well known that the adsorption of mineral and organic salts and colouring matter by boneblack varies, both in regard to the quantity removed and the tenacity with which it is held by the char, according to the nature of the substance filtered.

ELIMINATION OF COLLOIDS.

In this connexion we have particularly in mind the paper by PAINE and BADOLLET[2], entitled "Colloid Elimination during Bone-char Filtration in Cane Sugar Refineries," in the summary of which they state : "The most important fact brought out by these experiments is that the irreversible type of colloids (which is not removed because of inadequate defecation in the raw sugar factory) is preferentially and completely removed by the bone-char filters, and is not washed out during sweetening off. The reversible colloids are never completely adsorbed. The preferential action of bone-char for adsorption of irreversible colloids tends to reduce the adsorption of the more difficultly removable reversible colloids. In this connexion it is important to

1 Paper presented before the Division of Sugar Chemistry of the American Chemical Society Indianapolis Meeting, 1931. 2 *I.S.J.*, 1927, 375 379.

keep in mind that defecation of cane juice in raw sugar production eliminates practically no reversible colloids."

On the whole, our experience in the handling of Cuban sugars has corroborated the findings of these chemists, but we have found certain differences in the case of other sugars, such, for instance, as those produced in Natal from the Uba cane. In some cases the filtrates were never brilliant or lost their brilliance early in the filtration cycle. In less aggravated cases the brilliancy might be maintained but colour appeared in the filtrate much earlier than usual, and the bone-char rapidly reached a state of saturation with colloidal matter, which it then appeared to give up indiscriminately to water or any brilliant syrup which would, under our normal procedure, have followed behind the liquor. The brilliancy of the contaminated syrup could, in most cases, be completely restored by re-filtration over char, indicating that the former char had released an extensive amount of irreversible colloidal matter. Brilliance could also be restored by defecation with trisodic phosphate and press filtration, which also almost invariably resulted in a marked improvement of colour. Heat tends to coagulate the colloids in such syrups.

At a lecture delivered at McGill University, Dr. Steacie indicated that colloidal particles of the same composition assumed various phases dependent upon the numerical conjunction of their molecules. It is not our intention to attempt to show that the colloids are or may be present in any particular phase or form, nor to discuss any matters referring to such physical properties as surface tension, etc., which have already been taken up by many investigators. The purpose of this paper is to present the results of a limited investigation mainly from a practical point of view showing the relatiion between filtrability and refinability of any class of sugar.

"Filtrability and Refinability."

The word "Filtrability" has of late years been applied in technical parlance almost solely to indicate the quantitative passage of sugar liquors through standard press filters and units of area with the employment of various filter-aids. Accepting this term as tending to become more or less permanently fixed within these narrow limits, we propose here to apply it thus, and supplement it with, for want of a better word, the term "Refinability," which we use to indicate those changes produced in a press-filtered liquor after a definite volume has passed through a standard boneblack under comparative conditions.

When, from the examination of a series of sugar solutions by any comparative method (Elliot or other) a filtrability figure has been established, it is conceded that the data have practical value for the guidance of technical operations in the press station, but varying results will be observed in the appearance of the liquors after bone-char filtration, and also in the quality of the sugars and syrups obtained when these char filtered liquors have been boiled, as has been graphically shown in Table III, in the paper already quoted.[1]

It is known that sugar solutions with equal filtrability figures are not necessarily of equal brilliance and colour content, and as these differences must influence subsequent operations, filtrability should be supplemented with other data to suggest the probable refinability of the press-filtered liquors. It is, therefore, proposed to compare the effect of bone-char upon press-filtered syrups which contain microscopically visible colloids with others from which

[1] *I.S.J.*, 1927, 375-379.

the colloids have been more or less perfectly removed, especially in regard to the relative colour qualities resulting therefrom.

Having observed several liquors with approximately identical filtrability figures, it was seen that some had every indication of containing more colloidal material than others, usually with exceedingly high properties of dispersion of light. This condition was almost invariably accompanied with a higher colour content, especially of the red element as determined by the Lovibond tintometer. In certain cases the lack of brilliancy in these filtrates from the presses reached a stage which might be designated as cloudy. When such a persistently cloudy flow was characteristic of a particular raw sugar, the opalescence of the liquor could never be entirely removed even by repeated filtration over bone-char, and the general quality of the char-filtered liquor did not come up to standard.

On the assumption that certain colour elements, and what may be termed "colloidal haze," are due to the presence of very minute colloid particles, experiments were carried out which are here reviewed as briefly as possible. The colloidal haze is particularly to be observed in the majority of greens from granulated sugar boiling, and it was because of this that such greens were subjected to large scale experiments to be now described. Greens of a purity between 94 and 95° were chosen, reduced to 62° Brix. ; *pH* 7·25. A sufficient quantity was prepared to supply a special char filter running at the rate of 80 cu. ft. per hour for 100 hours. The filters had a capacity of 1000 cu. ft. of boneblack ; quality No. 2 ("B" char).

Purities and colour analyses of the greens after press and char filtration are given in Table I. The material before press filtration was too cloudy for reliable colour analyses. The two greens are respectively designated as *T* and *U*, viz., *T*, to which 1 cu. ft. of "Filter-cel," 25 lbs. of trisodic phosphate, and 12 oz. of lime in the form of milk-of-lime were added, and *U*, to which "Filter-cel" only was added. The syrups were prepared in batches of 300 cu. ft., uniformly filter-pressed, and then char-filtered as described.

TABLE I.

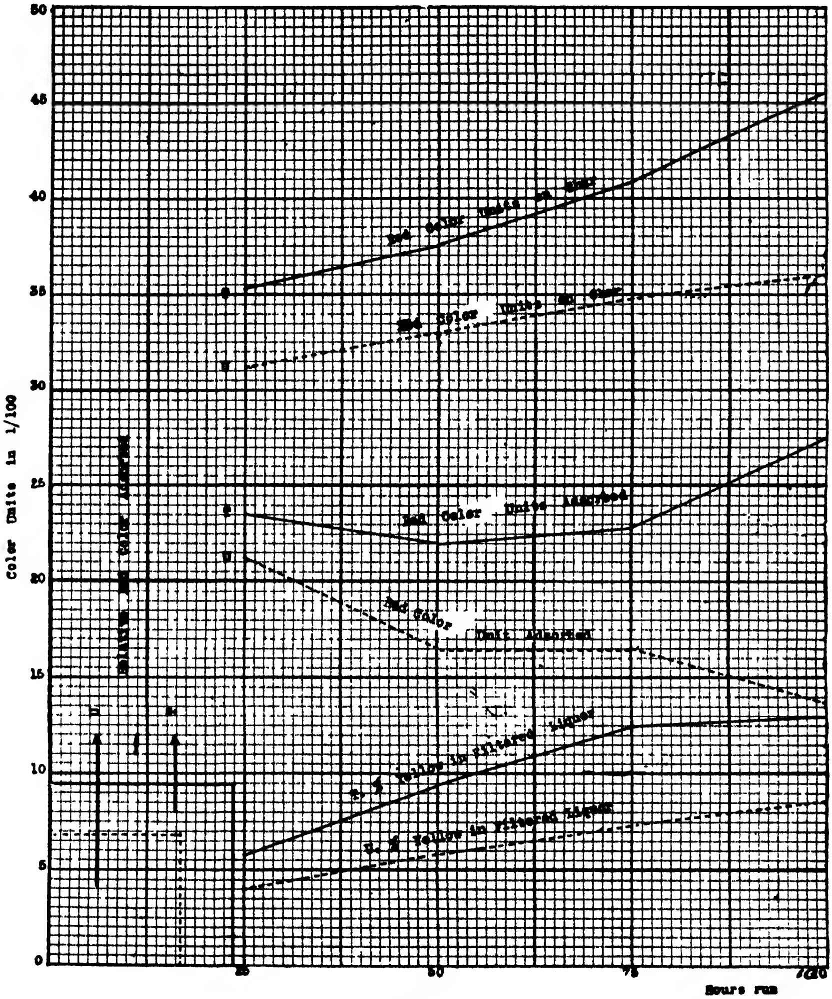
		"T"		"U"	
		Press filtrate on char.	Char filtrate off char.	Press filtrate on char.	Char filtrate off char
Purity		93·98	94·33	94·78	94·95
pH		7·60	7·20	7·25	7·25
Colour	Yellow	17·62	10·18	13·98	5·35
	Red	2·43	0·96	2·08	1·04
	Total	20·05	11·14	16·06	6·39
Per cent. Yellow		87·80	91·30	87·04	85·95

The colour elements adsorbed by the char are of a particular importance because the *T* filtrate (average) showed a reduction of red, 60·5 per cent., while the *U* was only 50 per cent. On the other hand, the Yellow element was more strongly adsorbed from the *U* than from the *T*, viz., *U*, 61·4 per cent. and *T*, 42·2 per cent. or a ratio of red to yellow in *U* as 1 : 5·14, and in the *T* as 1 : 10·6. Again, when we consider the ratio of red and yellow of the two syrups before char filtration we find *U*, 1 : 6·72 and *T*, 1 : 7·25, showing the selective adsorption of the undesirable red element to have been remarkably increased by the phosphate treatment.

SELECTIVE ADSORPTION.

But the full significance of the relative adsorption of colour from the two syrups will appear if colour units be calculated and colour analyses compared.

The colour units were calculated by the formula $\frac{HVST}{Bx}$ = colour units, in which : H = hours of liquor flow from char filters ; V = volume per hour in cu. ft. ; S = pounds solids in cu. ft. of syrup ; T = total colour : viz., yellow



GRAPH

and red ; and $Bx.$ = degrees Brix. Table II, then, shows the colour units, on, off and adsorbed by the char.

TABLE II.

Colour units on and off Char Filters.
(in thousandths of units.)

	"T" On	"T" Off	"T" Ads.	"U" On	"U" Off	"U" Ads.
Total	130	72	58	104	48	56
Yellow	115	66	49	90	41	49
Red	15	6	9	13·4	6·7	6·7

In this connexion, the selective action of char on the red element adsorption is graphically illustrated by plotting comparative curves of red units going on the char and the red units adsorbed. (See graph) The comparative yellow units retained in the filtrates T and U are also shown, but the curves are based on percentage of yellow colour, to accentuate the difference more markedly. In the lower left hand corner the areas show relative total adsorption of red element. It may here be stated that the treated filtrate yielded a very superior granulated sugar to that obtained from the untreated, and a suitable syrup for boiling soft sugar. The yellow colour can be readily filtered out if desired, but, as a rule, the retained yellow imparts a pleasing bloom to soft sugar.

NATURE OF TRAPPED COLLOIDS.

That by treatment with trisodic phosphate, colloidal gums have been trapped of an identical nature to those found in raw sugar[1] seems to be borne out by acetone and methanol extractions made upon the press-cake from the treated greens. The press-cake from these greens was washed with hot water until a trace only of sugar remained ; 12 grms. of the dried cake were then extracted and yielded to Acetone 0·88 per cent. (G), Methanol 0·342 per cent. (B):

$$\frac{100\,G}{G+B} = 72{\cdot}00 \text{ per cent.}$$

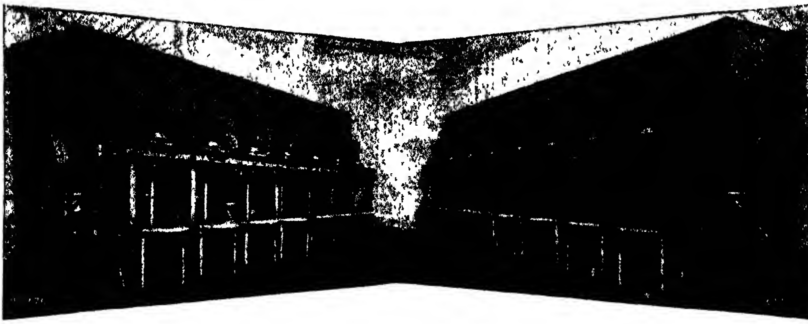
Furthermore, it is of interest to note that the extracts referred to as G and B are no doubt analogous to the reversible and irreversible colloids described by BADOLLET,[2] and particularly in respect of the feature that the ash in both cases is much lower in the reversible than in the irreversible ; the ash in G is always lower than in B. BADOLLET also terms these colloids Emulsoids and Suspensoids respectively. It would appear that emulsoids are chiefly responsible for the alteration of surface tension.[3] While considering this phase of the investigation it would appear as conclusive that both forms of colloids are persistently retained by char filtrates and eventually appear as a colloidal haze in the greens from all sugar boilings. It is to be remembered that the greens of these experiments had been derived from clear liquors under microscopic inspection.

RAW SUGAR TREATMENT.

If we now pass to the investigation of a similar treatment of a raw sugar, and this has particular bearing on the question of Filtrability and Refinability, we find quite similar results. To this end a sufficient quantity of unwashed Natal sugar was dissolved to a normal density so as to accommodate two Sweetland presses, and provide exactly the same material for both. To one portion was added 0·35 per cent. of " Hyflo Super-cel " on solids dissolved, and to the other 0·35 per cent. of " Hyflo Super-cel " plus 0·15 per cent. trisodic phosphate, and each portion run into a separate Sweetland press under identical conditions of heat and pressure. When the filtrates were running as clear as the press could deliver them (which in the case of the liquor treated with the phosphate was almost immediately) a large sample of each filtrate was taken, and carefully preserved in a stoppered container. Experimental char filters were prepared as described in an Article entitled : "Application of the Tintometer to Sugar Factory and Refinery Control"[4] The press-filtered liquors were run simultaneously on to companion filters, filled with the same grade of boneblack, until 7200 c.c. of the filtrates had been collected in 12 portions of 600 c.c. with the results shown in Table III.

---

1 *I.S.J.*, 1928, 488-493.
2 *Ind. & Eng. Chem.*, 1924, 1252. 3 *Ind. & Eng. Chem.*, 1924, 813. 4 *I.S.J.*, 1917, 306-312.



The Maxwell-Boulogne PATENT Simplified JUICE SCALE

NOW THE CHEAPEST STILL THE MOST ACCURATE AUTOMATIC SCALE

Extract from certificate received from Java Proefstation Pasoeroean

"—It is the most accurate weighing machine which exists, it is perfectly mechanical and automatic and needs no supervision. Its construction is so strong that it will, for years, need no repair."

The Director of the Java Experiment Station

(Signed)
Dr Ph. van Harreveld

59 WORKING IN JAVA

Weighing Raw Juice, Imbibition Water, Syrup, Molasses, and Diluted Filter Mud.

GEORGE FLETCHER & CO., LTD.
DERBY ENGLAND

TABLE III.

Filtration Test on Whole Natal Sugar dissolved in Water to 60° Brix.
Original Solution roughly strained :—
Yellow 77·0 ; Red 23·1 ; Blue 6·0 ; Total 106·1.
" U " Treated with Earth only.
60 lbs. Earth to process.

	Colour Analysis. Yellow	Red	Blue	Total	pH	Approx. Purity
Press Filtrate	64·30	13·00	3·40	80·70	6·23 —20†	96·50
Char Filtrate—						
After 2 hours	0·95	0·46	—	1·41	5·97 —10†	97·27
3 "	1·40	0·60	—	2·00		
4 "	2·20	1·10	0·10	3·40		
5 "	2·51	1·20	0·12	3·83		97·23
6 "	3·00	1·30	0·15	4·45		
7 "	3·50	1·50	0·22	5·22		
8 "	3·50	1·50	0·20	5·20		97·16
9 "	3·90	1·70	0·26	5·86		
10 "	3·80	1·60	0·20	5·60		
11 "	4·00	1·75	0·26	6·01	5·85	97·01
12 "	3·90	1·65	0·26	5·81		
Average	2·97	1·30	0·16	4·43		97·17
Per cent. Colour removed	95·38	90·00	95·30	94·50		
Sample No. 12 after treatment with Na_3PO_4	3·70	0·42	—	4·12		

"T" Treated with Earth and Na_3PO_4
60 lbs. Earth + 25 lbs. Na_3PO_4

	Colour Analysis. Yellow	Red	Blue	Total	pH	Approx. Purity
Press Filtrate	39·50	7·80	1·65	48·75	6·80 —45†	96·64
Char Filtrate—						
After 2 hours	0·50	—	—	0·50	5·98 —10†	97·59
3 "	0·54	—	—	0·54		
4 "	0·64	—	—	0·64		
5 "	0·90	0·08	—	0·98		97·45
6 "	1·20	0·12	—	1·32		
7 "	1·45	0·17	—	1·62		
8 "	1·55	0·18	—	1·73		97·11
9 "	1·70	0·19	—	1·89		
10 "	1·80	0·20	—	2·00		
11 "	2·00	0·32	—	2·32	5·98	97·01
12 "	2·30	0·34	—	2·64		
Average	13·20	0·15	—	1·47	—	97·29
Per cent. Colour removed	96·60	98·00	100·0	97·00	—	—

† Titre figure using brom-thymol blue as an indicator.

CONCLUSION.

In conclusion it may be stated that the filtrability figure is at best a mere indication of the probable efficiency obtainable in the filter-press station, and even in this respect is not very informative when the whole sugar is used, since this is never done in practice, and affining removes the most objectionable features of the raw sugar. Further it has here been shown that the rate of flow through the press filters is no indication in itself of the refinability of a raw sugar, but that on the other hand the refining quality of any raw sugar

can be vastly improved by chemical defecation used in conjunction with a filter aid at the press station, although such treatment will materially slow up the rate of flow and furnish a poor filtrability figure.

Good affination work will usually yield a washed sugar, which will give a good filtrability figure, although the refinability may be poor. This in turn can be overcome by chemical defecation of the greens from the granulated sugar boilings, and the filtrates will have a high refinability value as has been shown in the case of *T* and *U* syrups. The test on the liquors *T* and *U* was made specially for the purposes of demonstration, since, as has already been mentioned, raw sugar is always washed. By chemical treatment of the syrup and washings from the raw sugar the bulk of the disturbing colloids are taken out of the system, and the refinability of the filtrate is greatly enhanced. It would therefore appear that, to judge the refining value of any raw sugar, there should be used in addition to the filtrability test some adjunctive method of determining directly the extent of the treatment necessary to produce a standard of refinability.

Sugar Production in the Dominican Republic.

Department of Overseas Trade Report.[1]

Sugar production is the chief industry of the Dominican Republic and the heavy slump in the world sugar markets has been severely felt. The 1930 United States tariff changes have also affected sugar prices here and have in effect given a preference to Cuba, with which country the Republic was formerly able to compete. It has also made it difficult if not impossible to export sugar cane to Porto Rico for grinding there. There are fifteen mills in the Republic, all but two of which are in the southern portions. All but five are American owned and this has somewhat mitigated the effect of the slump in the Republic, since a great part of the financial loss has been borne outside the country, but the part that has been borne in the Republic is sufficiently important to make the sugar regions poverty stricken.

Sugar grinding begins in this country in January and ends in May or June. It is estimated that the 1930 crop amounted to 396,953 short tons, as compared with a production of 396,575 short tons in 1929. The nearness of these figures is only a coincidence. Early in the year the estimate was 419,000 tons although less cane was being ground than in 1929. The sugar yield was higher, averaging from a minimum of 9·84 per cent. to a maximum of 13·069 per cent. About one-third of the production has not yet been exported or has been used for local consumption. There is only one refinery in the country, for local use only. It has not been found satisfactory to refine for export markets. The hurricane did not do much damage to the 1931 sugar fields, but as there has been decreased expenditure on cultivation and planting, the 1931 crop is likely to be smaller. All estates have been carrying out a campaign of stringent economy, and some will probably not grind but their crops will be sent to neighbouring mills.

Raw sugar exports in 1928 amounted to 335,019,937 kilos valued at $16,911,925 of which 248,944,490 kilos valued at $12,539,593 were shipped to the United Kingdom and Ireland. Most of these exports were shipped to "Queenstown for orders." In 1929 exports amounted to 322,088,222 kilos valued at $12,258,831, of which 232,860,006 kilos valued at $8,754,857 were shipped to the United Kingdom and Ireland.

THE JAVA 1930 SUGAR CROP.—It is reported from Java that the sugar content of the cane now being milled is low and does not improve. Accordingly, a decrease in the estimates of the output is assumed, but no definite figures are to be expected much before August.

1 From "Report on Economic Conditions in the Dominican Republic to November, 1930." (H.M. Stationery Office.)

Mauritius.

Department of Agriculture Report for 1929.

The annual Report of the Department of Agriculture of Mauritius for the year 1929, as prepared by the Director of Agriculture, Mr. D. d'Emmerez de Charmoy, contains the following information with regard to the sugar industry in that island.

The production of sugar, which is the principal crop in Mauritius, was for 1929, 238,035 metric tons (234,276 English tons) distributed in grades as follows :—vesou 23·9 per cent. ; raw sugars 75·2 per cent. ; low sugars 0·9 per cent.[1] This production would no doubt have been higher if the fields had received in time the usual care that is bestowed on them but owing to the crisis caused by the low prices of the preceding crop and the unsatisfactory prospects this could not be done, the planters, the small ones principally, having been faced with considerable pecuniary difficulties. Fortunately the difficulties were alleviated to some extent though rather late, by means of an assistance from Government in the shape of a loan of Rs. 6,000,000 repayable during a certain number of years by means of an export duty of 50 cents per 100 kilos.

Owing to the altered conditions of the sugar market, manufacturers found it more advantageous to produce a larger proportion of raws than heretofore. The total tonnage of cane ground approximated to 2,195,400, giving a mean extraction of sugar of 10·84 per cent. of cane. The area under cane cultivation at the beginning of 1929 was 157,700 acres, a figure practically identical with that for the previous year. Estate plantations covered 83,760 acres, the rest being made up of planters' canes, more than half of which belong to Indians.

Little change was brought during the year to the existing machinery on estates. Importations in this respect reached Rs. 752,000. A sum of Rs. 8000 was contributed by the Sugar Industry Reserve Fund for the purchase of machinery for experimental purposes. The apparatus ordered have been installed at Mon Désert Factory in a central locality where they can be inspected by all interested. In relation to tramway material the falling off in importations was considerable : Rs. 156,000 in 1929 as compared with Rs. 411,000 in 1928.

With regard to the irrigation problem, mention should be made of the mission entrusted to Mr. E. Lesur, an Officer of the Department, for the purpose of studying the methods employed in Hawaii. The application of these methods in Mauritius has been started successfully. This question has been the object of special studies by this Department in view of the Irrigation Scheme of the Northern Districts of the Island. For this purpose extensive mechanical analyses of soils of the whole northern area have been performed with the object of determining exactly the nature of these soils and the possibility of placing them economically under irrigation. The Hawaiian methods have been put into practice by Mr. Lesur since his return to Mauritius and have proved to be more advantageous than those practised hitherto, in that they require less water for a given area and at the same time allow substantial savings to be made with regard to labour.

In relation to insect pests of the sugar cane, the outstanding factor continues to be *Phytalus Smithi*. Over 250,000,000 beetles were destroyed during the year and nearly 100,000,000 larvae captured. The total cost of the campaign against this pest exceeded Rs. 110,000. Experiments have been con-

[1] This compares with 251,100 metric tons in 1928, of which about 73 per cent. consisted of vesou sugars.

tinued during the year, in relation to the life history of the insect, its ecology, and natural enemies as auxiliary means of control.

As regards fungoid diseases of the sugar cane, the most important continues to be Leaf Scald to which White Tanna, which occupies 50 per cent. of the cultivated area, is peculiarly susceptible. The extent of the disease is not, however, greater than in 1928. In this connexion Professor ASHBY, Mycologist of the Imperial Bureau of Mycology, visited the island in October, 1929, to investigate matters in relation to fungoid diseases of the sugar cane. Before leaving the Colony he gave a lecture on all the diseases from which sugar canes were suffering in Mauritius, pointing out the necessity to combat seriously the two principal ones, viz., Gummosis and Leaf Scald, by means of a rigorous selection and by what appeared to be more important, the substitution of new varieties more resistant to these diseases.

No increase of Gummosis on the island as a whole was observed in 1929 as compared with 1928, and it is gratifying to note that many planters are making efforts to eradicate this disease and scald, or at least keep them in check by the selection of healthy planting material and the propagation of resistant varieties, of which there are many amongst the new seedlings raised locally and some imported from abroad. Nearly every estate now has its own nursery of new seedlings with the object of selecting for propagation those both resistant to disease and suitable to the particular locality in each case.

The Chemical Division carried on during 1929 various branches of investigational work, dealing, inter alia, with Deficiency of soils in phosphates from analyses of cane juice, Synthetic farmyard manure (Adco), Liming experiments. Determination of phosphates by colorimetric methods and Cane growth measurements.

From the economic point of view, the year under review was decidedly unfavourable. The average sale prices for sugar approximated to Rs. 7·50 per 50 kilos, a figure which is in many cases below the cost of production. As a result, many sugar concerns closed the year with a deficit. The Secretary of State for the Colonies delegated Sir FRANCIS WATTS, K.C.M.G., D.Sc., to investigate matters and report thereon, with a view to putting the whole industry on a sounder economic basis. During his stay the services of the Sugar Technologist were placed at his disposal to render his task easier and he remained in close touch with the Department in connexion with information which he required.

In continuation of the arrangements made the year before with the object of producing new varieties of sugar canes, a special branch of Research has been created and attached to the Department of Agriculture. This Branch comprises a Geneticist, a Bio-Chemist and Soil Physicist, a Botanist and three Assistants, graduates of the College of Agriculture. The Geneticist is to be the head of the Branch. The Branch is financed partly by the Empire Marketing Board, partly by the College of Agriculture and the Improvement and Development Fund. Its total annual cost is estimated at Rs. 50,000.

During the year some 12,000 seedlings have been raised at the Royal Botanical Gardens at Pamplemousses, the new Station created for cane breeding under the supervision of the Cane Breeding Officer, Mr. A. DE SORNAY, who was sent to Coimbatore to study cane breeding. About 6000 seedlings have already been planted out and are under observation. Five Experimental Stations have been established in various localities of the Island with a view to determining the type of cane varieties, both imported or locally produced, best suited for local conditions. Cuttings of new varieties

are being distributed to estates and nursery fields established in co-operation with estates. The POJ 2878 cane was imported from Java and is undergoing a greenhouse period of trial.

The Sugar Technologist's report included the following information :—

The production of raw sugar during 1929 increased from 50 per cent. in 1928 to over 80 per cent., most of it being sold to the British refiners. The sucrose content of the cane was slightly lower than the average for the two previous years, but the mill extraction and the recovery were comparatively higher, due to the improved efficiency of the work and to the larger proportion of raws. The good quality of the juice and the experience gained the previous year made the manufacture easy. Five factories produced raws of a satisfactory standard without any sulphurous acid or, in other words, using lime only for the treatment of the raw juice. This practice will probably generalize, for it has several advantages, the most important being a lowering of the actual cost of production and of the upkeep of the factory. Sugar dryers continued to render good service. More water-cooled crystallizers were installed and there was a tendency to increase the capacity of the centrifugal department.

Thirty-one factories out of 43 in the island contributed to the Controle Mutuel and returns were regularly distributed fortnightly amongst contributors.

A new feature in the chemical control of two of the factories is the installation of weighing machines for the juice and the exhausted molasses and of accurate measuring devices for the maceration water. This has increased the accuracy of the data obtained. A patent was taken out by Mr. Robert Menagé, factory manager of Savannah Estate, for an automatic measuring tank for liquids of all sorts, from water to syrup inclusively. This device is very simple and ingenious and is likely to give reliable information. It is anticipated that new installations of weighing and measuring machines will be made in the near future.

Abstracts of the International Society of Cane Sugar Technologists.

Under the scheme instituted by the I.S.C.S.T. a collection of abstracts of papers on agricultural and technical subjects is prepared monthly. A selection from these " Sugar Abstracts " has been made by us from the material issued, and appears below :—

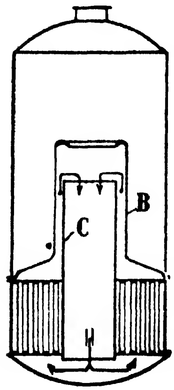
Beet Sugar Manufacture.

Wheatland, the G.W.S. Co.'s New Factory. **G. Hrudka.** *Die deut. Zuckerind.*, 1931, **56**, 243-247.

An extended description is given with illustrations and flow sheets of this new beet factory, considered to embody the most approved designs and arrangements suggested by the experience of the G.W.S. Co. Among the notable external features of this plant are the great concrete silos for the bulk storage of granulated sugar, and the absence of a smoke stack (the boilers using artificial draught). Internally the arrangement is marked by a thorough-going automatization and mechanization to reduce labour costs, the personnel being reduced to what appears to be a record low figure. Including the superintendent, 15 foremen and a laboratory staff of 14, the entire staff includes 165 men in the three shifts, and deducting the superintendent and laboratory staff the factory is run by 50 men per shift, or 1·25 men per 100 tons of beets. Juice purification is effected by continuous carbonata-

tion, controlled by the Dorr electrically regulated CO_2 gas valve, the juice being settled in a 4-tray Dorr clarifier. The entire operation of the 1st and 2nd juice filtrations including the thickener is controlled by a single labourer. The filter-cloths of the Oliver filters were renewed only once during the campaign. About one-third of the carbonatated juice is re-circulated.

STUDIES ON EVAPORATION. **O. Pankath.** *Centr. Zuckerind.*, 1931, **39**, 278-279.



Various experiments are described, the results of which confirm the principle that the heating steam in multiple effect evaporation should be introduced into the heating compartment from below. Another indication obtained is that the circulation tube of the usual Roberts tube does not produce a correct circulation of the juice because the steam bubbles throw the juice into a confused motion. The author's suggestion for remedying this condition is illustrated in the accompanying drawing. *B* is a hood open at the top, and *C* a prolongation of the wall of the circulation well. The contents of the evaporator are kept at a level such that *C* is nearly full. If *C* is of the right height, bubbles of vapour will form only in the annular space between *B* and *C*.

PREVENTION OF JUICE COLORATION BY THE PRESENCE OF CARBON, SODIUM SULPHITE, ETC. **V. Stanek and P. Pavlas.** *Zeitsch. Zuckerind. Czechoslov.*, 1930-31, **55**, 339-348.

Continuing previous work[1] the authors have found second carbonatation scums to be capable of preventing the formation both of colour during evaporation and of scale, if added in an amount not exceeding 0·2 per cent. of the dry substance. Also, 0·02 to 0·05 per cent. of Norit added to the juice is sufficient to produce a great improvement in the colour of the thick-juice, not so much by its direct decolorizing effect, as by preventing new colouring matter from being formed. Probably the action is due to the mechanical effect of the carbon particles in promoting the formation of steam bubbles, thus preventing local over-heating, but the carbon cannot be recovered and used indefinitely, as by the 4th repetition it has entirely lost its favourable influence. Very small additions of sodium bisulphite, 0·0025 to 0·05 per cent., also exert a very favourable effect on the colour of the syrup. In practice the bisulphite may be continuously added to the thin-juice in the form of a 20 per cent. solution, so-called " neutral sulphuring," excellent results being reported from three factories. In one case the colour of the thick-juice was reduced from 20 to 10° Stammer on the dry substance. Neutral sodium sulphite is not so efficacious.

CRUSHING AND SIFTING SUGAR. **W. Taegener.** *Centr. Zuckerind.*, 1931, **39**, Nos. 9 and 10.

This is a useful description of methods and machinery as used in factories in Germany.

RAFFINOSE IN FRENCH MOLASSES. **Émile Saillard.** *Supple. Circ. hebd.*, No. 2193.

Four samples of molasses taken at four different periods during the campaign at a factory in northern France gave the following differences between

[1] *I.S.J.*, 1930, 36.

the direct pol. and the sucrose by Clerget : 1·76, 2·09, 2·65 and 2·98. This steadily increasing difference is ascribed to the progressive formation of raffinose, the effect of the gradually lowered temperature to which the beets are exposed as the season advances. In the south of France where the temperature averages higher, the difference is much less.

Cane Sugar Manufacture.

Clarification and Disposal of Settlings. **W. E. Smith.** *Proc. Hawaiian Sugar Planters' Assoc.*, 1930.

During the past 10 years the H.S.P.A. has made a comprehensive study of clarification. One result found is that the maximum increase in purity from mixed juice to syrup was obtained when limed juice was maintained at a *pH* of 8·0 to 8·3. No inversion results. Another improvement is the insulation of settling tanks, so that at the week-end clean-up or when working single shift, the juice will not cool to the point where bacterial action can begin. This reduced undetermined losses in intermittent operation. The Dorr clarifier is now used in the production of more than one-third of all the juices produced in Hawaii. Continuous liming devices facilitate closer control of juice reactions, and when the lime is added to the suction of the mixed juice pump the necessity of holding quantities of limed juice in storage is avoided. A factory which has installed Kopke mud separators makes only one separation giving a residue of 2·5 per cent. polarization at 75 per cent. moisture, which is a loss of 0·51 per cent. of the polarization of the cane. The cost of operating and maintaining the machines is less than 0·5 cent. per ton of sugar, and the result is that the over-all cost, including the sugar lost in residue, is said to be below the average for all the other factories. In order, however, to reduce the sugar losses the settlings have to be diluted with much water, but where the factory has a surplus of bagasse, or no outside loads (irrigation pumps) which call for all available steam, this is not much of a handicap. The Oliver filter has given outstanding results when working on cane settlings in two Hawaiian factories. There has been a marked saving in labour costs as compared with the old plate-and-frame filter, and the polarization in filter-cake has been reduced to well below the Hawaiian plate-and-frame average.

Heating and Evaporating. **W. E. Smith.** *Proc. Hawaiian Sugar Planters' Assoc.*, 1930.

A development in the design of heat transfer equipment that has greatly increased the heating surface capacity of juice heaters, evaporators, and vacuum pans is the provision of baffles on the steam sides of such apparatus, by which the velocity of the steam is kept up to the most effective rate of flow. In the case of juice-heaters the standard requirement of heating surface per ton of cane per hour has been reduced from 35 to 20 sq. ft. By similar means, rates of evaporation in some countries have been raised to 12 lbs. of water per sq. ft. Pre-evaporators with tubes 8½ ft. long and with a vapour belt 12 ft high above the upper tube sheet are successfully operated without any particles of liquid reaching the save-all. The mill of the Honolulu Plantation Company (said to have the most complete system of vapour utilization of any cane factory in the world) depends on vapour from two pre-evaporators to furnish much of the heat required for working heaters and pans. The author favours multi-jet condensers in situations where water under gravity pressure of 3 to 4 lbs. is available. At Lihue there has been installed a 10,000 sq. ft. baffled cell as the first unit of a quadruple effect ; the other cells, unbaffled, average slightly over 4000 sq. ft. each. This installation is considered to have settled, for all time, the contention that the capacity of a

quadruple of unequally sized cells is no more than the normal capacity of the smallest cell multiplied by 4 and has proved that the total square feet of heating surface is the criterion by which to judge capacity; the temperature will adjust itself so as to maintain approximately equal evaporation in each unit.

MOLASSES, "FANCY" and "CHOICE." **S. J. Saint.** *Rep. Dept. Sci. Agr. Barbados*, 1929-30, 72-74.

Muscovado sugar is manufactured by a number of Barbados mills, the output of this grade being dependent on the demand for the product called "choice" molasses. Methods producing this molasses are mostly empirical, but the author has found that the best quality is obtained when the *pH* of the clarified juice is about 7·2. Where the reaction of the clarified juice is thus controlled, the juice may simply be concentrated in the Aspinall pan until its boiling point, as shown by a thermometer affixed to the pan, has reached about 230°F. The object is to produce a large-grained coloured sugar from which the molasses will readily separate. Various methods of controlling graining are suggested. "Fancy" molasses is made by direct evaporation of cane juice, the outstanding problems being here the removal of "mud" or sediment and the inversion of sufficient sucrose to prevent crystallization of the concentrated syrup. From the author's studies the juice should be limed to *pH* 6·0 to 6·2; after clarification, vinegar made from cane juice (by acetification of juice that has been fermented with yeast) is added until the reaction is brought down to about *pH* 4·5 depending on time and temperature of the juice-boiling operation, which vary from factory to factory. After the juice has been finally concentrated in the Aspinall pan, it should be centrifuged while still hot in a centrifugal to remove all suspended matter. Very brilliant syrups may be thus obtained.

ANNUAL SYNOPSIS OF PHILIPPINE MILL DATA, 1929-30. **E. T. Westly.** *Annual Reports Philippine Sugar Assoc.*, 1930, 175-208.

This annual summary of results is given for 28 Philippine centrals, which is nine more than reported the previous year. Factories reporting ground 5,944,727 metric tons of cane and manufactured 701,263 tons of sugar. General averages for the season were as follows :—

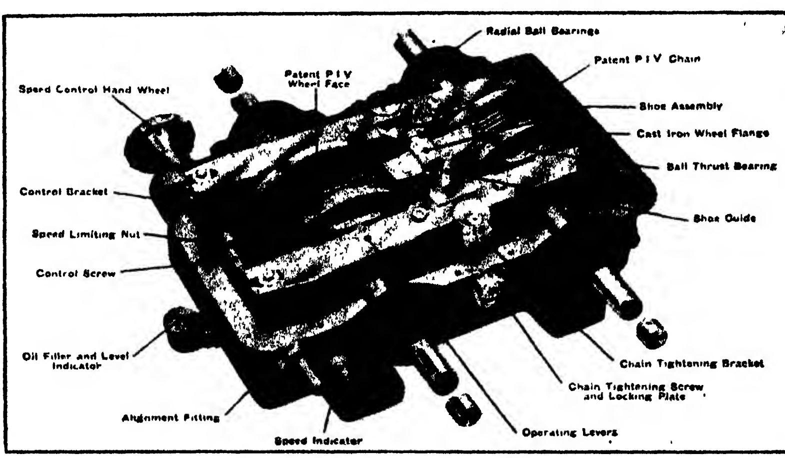
Cane—	
Pol. per cent. cane	13·32
Fibre per cent. cane	11·38
Tons cane per ton sugar	8·48
Sugar—	
Polarization	96·67
Moisture	0·79
Sugar per 100 cane	11·80
Milling—	
Tons cane ground per hour	77·02
Tonnage-fibre ratio	24·76
Extraction per cent. pol. in cane	93·56
Dilution per cent. absolute juice	9·02
Bagasse per cent. pol.	3·59
Bagasse per cent. Moisture	47·77
Bagasse per cent. cane	23·87

Juices—	Brix	Apparent Purity
First expressed	19·09	85·60
Last expressed	7·13	76·23
Mixed juice	16·52	83·72
Syrup	62·46	84·85
Kilos CaO used per ton cane		0·75
Filter Cake—		
Polarization per cent.		5·07
Moisture per cent.		66·47
Filter cake per cent. cane		2·03
Final Molasses—		
Brix		89·00
Gravity purity		37·17
Yield per ton sugar kg.		245
Losses per 100 pol. in Cane—		
Bagasse		6·44
Filter cake		0·77
Final Molasses (sucrose)		7·18
Undetermined		0·02
Total losses		14·37

Java Technical Notes.

New Devices for regulating Rotary Speed. **E. C. von Pritzelwitz van der Horst.** *Archief*, 1930, **38**, deel II, No. 43, 769-773.

For regulating rotary speed there exist at the present time a great variety of devices, purely mechanical, hydro-mechanical, or electrical, which, depending on the purpose for which they are to be applied, are more or less efficient. Compared with many of those on the market, the apparatus of the firm of G. Polysius, of Dessau, Germany, known as the "Speed Regulator" (*Umlauf-regler*), introduced about ten years ago, is an improvement. It has been successfully installed in several Java factories for driving the cane carriers. It consists of two pairs of conically-shaped discs, which are spanned by a wedge-shaped belt made to fit the slant of the discs. These discs rest in a strong cast-iron frame, and are arranged in pairs, each pair on a shaft, which runs in oil chamber bearings with ring lubrication. For the purpose of receiving and delivering, the power pulleys are keyed on to the shafts outside the frame. Both the pairs of cone-shaped discs are connected with one another by levers in such a manner that when the one pair is drawn apart the other



closes itself together, the driving belt thus being subject to the same tension at every point. The "Speed Regulator" is made in 12 sizes, which are again divided into 7 classes according to the limits of speed regulation required and the H.P. to be transmitted.

But what the author regards as a very ingenious improvement of this kind of apparatus is to be found in an apparatus originated in England and manufactured in Germany by the P.J.V. Ketten-und Getriebe G. m. b. H.[1] This apparatus is manufactured and sold in England as the "P.I.V. (Positive, Infinitely Variable) Chain Gears," and a gear-box (Type T.E.) with top removed, showing clearly its various parts, is seen in the illustration herewith. Two pairs of expanding pulleys of the opposed conical disc type are mounted one on the constant speed shaft of the gear, and one on the variable speed shaft. These opposed discs are provided with feathers and are adapted to slide axially on their respective shafts. Power is transmitted from one

---

[1] *Helios, Fach-und Exportzeitschrift für Elektrotechnik*, June, 1930.

shaft to the other by the patent P.I.V. chain which rides in the V formed between these opposed discs, and runs at a diameter depending on the axial distance separating the discs. The mechanism controlling the axial movement causes one pair of discs to approach each other as the other pair separate, so that the chain rises in one wheel by the amount that it descends in the other. Contact between the chain and the sides of the V of the wheels is made on pads built up of a large number of closely fitting laminations or " slats " which project through the frame of the chain. These slats are capable of a small movement across the length of the chain, which enables them to accommodate themselves to radial teeth cut on the working faces of the discs. There is no slip between the chain and the discs, and the speed can be varied when the gear is under load. There is a wide speed variation up to 6 to 1 in all gears except the smallest. An efficiency up to 95 per cent., which does not diminish in use, is claimed.

FINAL CONTROL FIGURES FOR 1930. **C. Sijlmans.** *Archief*, deel III ; Mededeelingen, 1931, No. 2, 11-83.

These numerous figures are collected in four tables from 176 out of 180 factories in Java, and are on the same lines as last year.[1] Purities (Sucrose/Brix) below 32 were reached by 11 factories, Blimbing (defecation) being lowest of all with 29·4. Eleven factories had a sucrose purity higher than 38, Assembagoes (defecation) being highest with 40·6. There were eight factories which had a higher unknown crystal loss per 100 pol. raw juice than 4·0, the highest being Tangoenan (sulphitation) with 5·1, its figure for " non-sugar in molasses per cent. non-sugar in raw juice" being 99. "Technical and Effective Results " are summarized for the past five years for defecation, sulphitation, and carbonatation factories, following being the average figures of all the 176 factories :—

	Technical Results.					Effective Results. Lost pol. per cent. pol. Cane		
	Pol. filter-mud per cent. non-sugar raw juice.	Sucrose total molasses per cent. non-sugar raw juice.	Unknown lost pol. per cent. pol. raw juice.	Comparison Figure of of Expt. Station.	Winter recovery (crystal).	In manufacture.	In bagasse.	Total.
1926..	2·3	44·5	2·2	10·4	97·2	10·9	6·1	17·0
1927..	2·9	41·6	2·0	9·8	98·0	8·9	5·6	14·5
1928..	3·4	43·0	2·0	10·2	97·6	8·8	5·4	14·2
1929..	3·3	45·5	2·2	10·8	97·0	9·3	5·4	14·7
1930..	3·3	45·4	1·9	10·5	97·4	9·5	5·2	14·7

Figures bearing on loss in molasses average out for defecation and molasses factories as follows :—

	Non-sugar in molasses per cent. non-sugar raw juice.	Sucrose purity of molasses.	Sucrose in total molasses per cent. non-sugar raw juice.	Non-sugar in molasses per cent. non sugar raw juice.	Sucrose purity of molasses.	Sucrose in total molasses per cent. non-sugar raw juice
1926..	93	34·2	45·2	95	34·0	46·3
1927..	89	34·3	43·1	93	33·3	43·3
1928..	90	34·8	44·3	91	34·2	45·3
1929..	91	35·4	48·0	96	34·9	48·3
1930..	92	35·5	47·0	96	34·8	48·3

Hence in 1930 and in 1929 the sucrose loss in the molasses was distinctly higher than in the three previous years tabulated. Last year it was suggested the ash content had something to do with this ; and now the following figures for the sucrose content of the molasses and the principal constituents of the

[1] *I.S.J.*, 1930, 249.

non-sugar, as percentages of the non-sugar, are shown. In these, the fall in the reducing sugar and the rise in the ash is significant :—

	Sucrose.	Reducing Sugar.	Ash.
		Per cent. non-sugars.	
1925	54·9	48·7	17·7
1926	53·3	50·2	19·4
1927	52·5	47·2	21·2
1928	53·8	44·3	20·9
1929	55·3	42·9	21·4
1930	55·5	42·2	22·3

Data relating to the capacity of plant at the different stations are presented as last year. These should be of interest to designing engineers. Some of the carbonatation factories produced sugars bearing comparison with European white sugars, but the product of some of the sulphitation white houses was hardly adequate. In general, however, the white sugars of 1930 had a better colour and a lower ash than previously.

BEHAVIOUR OF CANE MOLASSES DURING STORAGE. **G. L. C. La Bastide.** *Archief*, 1930, **38**, II, No. 30, 701-703.

As is known, during the storage of cane molasses the sucrose content generally falls, this often being accompanied by the formation of froth, so-called "froth fermentation," and the evolution of CO_2. BROWNE[1] has given a good account of the cause of this phenomenon, which gives rise to sugar losses often considerable. In this paper are recorded some observations regarding the behaviour of the pol., sucrose, reducing sugars, and the glutose of Java molasses at intervals up to 10 months from 15 factories, some of which figures are reproduced in the following table[2] :—

		Pol.	Sucrose	Reducing Sugars	Glutose
A.—Sulphitation Factories.					
I.	Initially	29·6	33·10	25·04	2·87
	After 4 months	28·2	32·97	24·23	4·04
	,, 9 ,,	27·6	32·99	23·07	4·31
II.	Initially	32·0	36·25	21·45	2·82
	After 4 months	31·2	35·62	20·58	3·80
	,, 9 ,,	30·4	35·02	19·52	3·84
III.	Initially	31·6	35·20	18·82	3·21
	After 4 months	30·2	34·22	18·51	3·70
	,, 9 ,,	30·0	34·09	17·80	3·68
B.—Carbonatation Factories.					
IX.	Initially	23·9	29·28	34·32	4·84
	After 5 months	23·0	28·79	33·29	4·88
	,, 10 ,,	20·8	28·12	32·95	5·67
X.	Initially	28·4	31·52	30·39	4·13
	After 4 months	27·8	31·56	29·33	4·63
XI.	Initially	26·8	32·43	24·23	4·24
	After 5 months	25·4	32·00	24·35	4·58
C.—Defecation Factories.					
XII.	Initially	30·8	33·90	29·40	3·24
	After 4 months	29·4	33·09	28·88	3·67
XIII.	Initially	30·2	33·51	23·33	2·88
	After 4 months	29·4	33·09	23·47	3·35
XIV.	Initially	36·6	39·44	20·48	2·22
	After 4 months	35·6	39·47	19·76	2·99

Examination of these figures shows that, even when the sucrose remains constant, or approximately so, the pol. always falls. Inversion occurs in most cases, the content of reducing sugars always or nearly always falling. Then

[1] *I.S.J.*, 1929, 509. [2] Only the figures of 9 factories are here given.

what is of interest to note is that in all cases the content of glutose (or unfermentable reducing sugars) increases, generally in the first month or so. According to prevailing opinion, sugar decomposition occurs especially with defecation molasses; but from these observations sulphitation molasses showed these changes to at least as great a degree, as, e.g., for example, in samples I, II, and III of the above table. Furthermore, it seems to be accepted that sugar decomposition and frothing take place simultaneously ; but this does not seem to be correct either, as it was noticed that frothing may stop after a couple of months, after which decomposition may continue.

PARTICULAR METHODS OF WORKING IN DEFECATION. SULPHITATION AND CARBONATATION FACTORIES. **C. Sijlmans.** *Archief*, 1931, deel III, Mededeelingen, No. 2, 84-103.

As an Appendix to the Factory Control Figures for 1930 some short descriptions are given of special modifications being operated during the period under review, some of which are briefly as follows : *Defecation.*—At Olean, Djatiroto I and several other factories the raw juice is limed at boiling temperature. At Pradjekan, Tangarang and elsewhere the unsweetened-off filter-mud is mixed with hot water and again filtered. At Winongan the raw juice is limed at 55°C. ; *A* and *B* massecuites are held two hours in the crystallizers, and *C* for about four hours ; and a Laval separator is being tried for the clarification of the *C* syrup. At Sempalwadek, *B*-massecuites are cooled in a Lafeuille crystallizer, the final temperature being 38-45°C., and then left for another two hours in an ordinary crystallizer. At Panggoongredjo, continuous hot liming is practised with calcium saccharate[1]; and at Porrong the spun molasses sugar is pugged with *A*-syrup and dissolved in the clarified juice. At Ketegan, Krian and elsewhere the juice subsiding with difficulty, some phosphate is added to the raw juice simultaneously with the milk-of-lime, using about 5 lbs. per 100 tons of cane ; likewise at Kon. Willem II where 1 litre of 5°Bé. solution is added per 1000 litres of juice.

Sulphitation.—At Bagoe the unsulphured evaporator syrup is passed through Sax filters. A number of other factories are using Sax filters in the same way. Several others filter their evaporator syrup generally after sulphuring through Kroog presses with the aid of " Hyflo-Filter Cel," using about 0·5 per 100 Brix. At Wonolangan the cold raw juice is allowed to run into milk of lime, mixed with boiling raw juice to about 8·5 *pH*, and sulphured at 75-80°C. At Pesantren, muddy juice filtration is applied, and the pre-heated, unsulphured evaporator syrup goes through *dooq*-filters. At Ngandjoek the sulphured juice is directly filtered through presses, 0·02 per cent. of " Hyflo-Supercel " being added when filtration slows down. All the pre-dried *C*-sugar is dissolved in thin-juice and mixed with sulphured evaporator syrup. At Kradjanredgo when the press-cake is removed from the cloth with difficulty, precoating with " Hyflo-Supercel " is practised, using 16 kg per 1000 q. of cane (35 lbs. per 100 metric tons). At a number of factories this same filter-aid is added to the muddy juice at the rate of about 10 kg. per 1000 q. of cane (22 lbs. per 100 metric tons). In several factories also the VAN DER JAGG method of liming[2] is used, molasses sugar being used for the preparation of the saccharate solution.—*Carbonatation.*—Mostly these factories returned remarks relating to the cooling of massecuites, and the disposal of the steamings from the pans, and otherwise repeat some of the modifications mentioned above.

[1] That is the Menang method, see Adv. Versl., 1930, 115.
[2] *Archief*, 1928, 36, I, 260.

British Beet Factory Annual Reports.

The Anglo-Dutch Group of Factories.

The following in tabular form gives the results of the five factories of the Anglo-Dutch group, for the year ended March 31st, 1931, compared with the results in the previous season.

	Ely	Cantley	Kelham	Ipswich	King's Lynn
Net profit—					
1930-1931	£61,241	£124,090	£14,853	£62,047	£45,487
1929-1930	£126,490	£150,318	£11,363	£61,396	£51,787
Div., tax free—					
1930-1931	12½%	20%	5%*	12½%	10%
1929-1930	12½%	20%	5%†	12½%	10%
To reserve—					
1930-1931	£4,991	£24,090	£7,755	£12,047	£487
1929-1930	£70,240	£50,318	£8,238	£11,396	£6,787
Sugar content—					
1931	15·72%	16·70%	17·55%	17·02%	16·10%
1930	16·83%	18·18%	18·42%	17·90%	17·20%
Number of Growers—					
1931	3,126	3,060	1,585	1,681	1,649
1930	2,932	2,937	1,222	1,332	1,416
Price paid to growers per ton—					
1931	46s. 8d.	49s. 8d.	52s. 6d.	50s. 9d.	47s. 11d
1930	50s. 1d.	54s. 7d.	55s. 5d.	53s. 8d.	51s. 4d.
Acres Grown—					
1931	29,208	30,556	11,572	18,326	22,010
1930	24,392	26,206	6,215	14,146	16,004

* Less Tax. † On increased capital: less tax.

The profits this year are thus mostly considerably less than in 1930; but most of the companies have large cash resources, so that it is possible to maintain the usual dividends. The much smaller dividend of Kelham is due to the fact that the Government hold 250,000 shares (now ranking *pari passu* with the other shares for present and future dividends) and so long as the Government do so, no dividend in excess of 5 per cent. can be paid.

Other Groups.

Central Sugar Company.—After allowing £35,000 (against £65,000) to depreciation, the year ended March last showed a profit of £47,324 for the Peterborough factory, or £8751 less than in the preceding year; (£10,000 (against £40,000) is placed to general reserve and a dividend is being paid for the year of 7½ per cent. free of tax (against 15 per cent. tax free), and £15,486 is carried forward.

Yorkshire Sugar Company.—Profits of the Selby factory for the year ended March last were £30,608 (against £28,037 for 1929-30) to which is added £10,106 brought forward. A sum of £27,564 is placed to depreciation and the balance of £13,150 is carried forward. No dividend has been paid on the share capital since the 5 per cent. distributed in 1928.

Lincolnshire Sugar Company.—The trading profit of the Bardney factory for the year ended March 31st amounted to £67,271 (against £76,025 for 1929-30), and after deducting the usual charges there was a net profit of £48,292 (against £65,047). Again no dividend is being paid, but the carry forward is increased from £31,104 to £44,397, and £16,000 is placed to depreciation reserve. The Brigg factory shows a profit of £44,983, and £10,000 is carried forward, the rest going to depreciation and tax reserves and in writing off preliminary expenses. No dividend is being paid.

Beet Sugar Factory Technical Notes.

Pressure Evaporation.—Not only can one obtain a lighter-coloured thick-juice in a pressure evaporator than in one working under vacuum as ordinarily, but savings in coal have been established. When pressure evaporators are first put into operation, remarks T. M. HAYEK,[1] Manager, Irish Sugar Mfg. Co., Ltd., there will always be some difficulties, but then it is a matter of estimating the steam distribution of the factory according to the requirements the new plant. Such calculations must be based on the fact that the juice has to flow through as quickly as possible, which result can only be obtained by taking sufficient exhaust steam from each body to do all the sugar boiling and juice heating. The maximum fuel economy and the most satisfactory colour of the thick-juice will be obtained when the lowest level of juice is maintained in the evaporators, and when the heating surface of each body is used to its maximum capacity. At Carlow the pressure evaporator did not at first give results as favourable as was expected, but now that the steam distribution has been changed, the results are considered to be satisfactory. Last year's consumption of coal there amounted to 6·7 per cent., using Welsh Duff of 6800-7000 calories ; and the colour of the thick-juice seldom exceeded 6° Stammer up to the middle of January, being in fact for days at a time only between 4 and 5°. Their molasses production amounted to 2·6 per cent. of the roots, and the lime used to clarify the juices only to 1·4 per cent.

Optimum Alkalinity.—Theoretically, says E. SAILLARD,[2] incrustation in the pre-evaporator, or in the 1st body if there is no pre-evaporator, should contain little or no calcium or magnesium carbonate. If either is present, it is because the final carbonatation has been pushed as far as the formation of soluble bicarbonates, which are not entirely decomposed afterwards in the pre-evaporator. One should ensure that the juice going to the evaporator should have such an alkalinity as to give a syrup of a suitable alkalinity for sulphitation. It may be that the natural alkalinity of the juice is sufficient to realize these conditions if the final carbonatation is stopped when the lime is entirely precipitated ; but if this is not so it is necessary to have recourse to the use of carbonate of soda, so that when all the lime is precipitated there remains a sufficient alkalinity in the juice. Methods have been proposed in Germany by SPENGLER,[3] DUWELL and SOLON,[4] and BÖTTGER[5] to determine this residual alkalinity, but it is better to use a method imitating practice, such, e.g., as the following : (1) Heat some of the 1st carbonatation juice to the temperature of factory carbonatation ; (2) carbonate it ; (3) from time to time remove 50 c.c. portions, filter, heat to 90°C., add acetic acid and ammonium oxalate, and boil, when if lime is still present a white precipitate of calcium oxalate will form ; (4) continue bubbling the gas into the juice until according to the oxalate test none remains in the filtrate ; and (5) lastly determine the phenolphthalein alkalinity of the filtered carbonatated juice. This alkalinity is that which should be observed if it has been found to give syrups of sufficient alkalinity for sulphitation. If the syrups have insufficient alkalinity to permit of a good sulphitation, it is necessary to add carbonate of soda before the 2nd carbonatation.

A pre-defecation Process.—Dr. E. NAEHRING gives an account of a modification of the carbonatation process of clarification by which an improved quality of white sugar is obtained.[6] This consists in adding the lime in two stages. Examination of the Teatini process in the laboratory had led to the

1 *British Sugar Beet Review*, 1931, 229-230.
2 *Circ. hebd.*, No. 2174. 3 *I.S.J.*, 1930, 37. 4 *I.S.J.*, 1931, 79. 5 *I.S.J.*, 1930, 366.
6 *Deut. Zuckerind.*, 1930, 55, No. 51, 1353.

conclusion that pre-defecation with 0·15 to 0·20 per cent. of lime (as CaO) had a marked effect in improving the quality of the juices, though after the addition of SO_2 no further effect was noticed. In factory tests utilizing this idea of adding the lime in stages, 40 litres of milk-of-lime were added to each measuring tank; this giving an alkalinity of 0·03 per cent. CaO, after which the juice was heated to 90-95°C. A further addition of milk-of-lime followed, this making up the dose of lime for the 1st carb. to 1·25 to 1·50 per cent. First carbonatation was pushed to 0·85 grm. per litre; a further 0·05 per cent. of lime was added after filtration, and next came second carbonatation and sulphitation with the addition of soda ash to precipitate the lime salts, the final alkalinity being 0·12 to 0·17 grm. per litre. On leaving the quad, the syrup was sulphited to 0·35 grm. per litre. According to the author, striking results were obtained. Coloration during evaporation had diminished, in fact in some tests none had occurred. The quality of the sugars was superior (type 5·0) to that obtained in the ordinary method working (type 4·1 to 4·3), being in fact as good as with the Teatini process. The rendement was raised (from 90·71 to 91·77), and the green syrups were distinctly lighter. Indeed better results all round were obtained with this 2-stage process, making the author wonder whether if the lime were added in three stages yet better results would not be obtained.

Solubility of Glasses.—KREUSLER,[1] in a study on the determination of ammonia in organic compounds was one of the first to draw attention to the importance of the quality of the glass on the error which may arise in such estimations. Numerous other investigators since then have considered the point, but have been hampered by lack of suitable method. At the present day, however, a suitable means of appraising the quality of various kinds of glass in respect of its solubility, a point of some importance for H.I.C. determination, is to be found in the application of electrical conductivity. This was the method of working used by J. PELLER[2] who gives the following figures representing conductivities. He used flasks of various makes, which were used to heat: (*a*) distilled water, and (*b*) sugar solutions of 10, 26, and 45 per cent. at boiling point for 6 hours.

	Distilled water	Sugar Solutions. 10	26	45
Kavalier, used	0·0012400	0·004518	0·003837	0·002418
,, new	0·0036890	0·005318	0·004953	0·003209
Jena, used	0·0017914	0·003891	0·003084	0·002427
,, new	0·0033650	0·005523	0·004873	0·000336
Pyrex	0·0017274	0·004557	0·004127	0·002588
Resista,	0·001608	0·005397	0·005086	0·003411

It was concluded from these and other results, some of which were carried out in the cold, that the solubility of glass in 26 per cent. sugar solution, compared to ordinary distilled water, averages about 3½ times greater. It is noticeable in these results that " Pyrex " glass did not give a result generally superior to the other glasses. In the case of a normal sugar solution, these results mean that the liquid may be contaminated to the extent of 0·0003 to 0·0006 per cent., and that the greater part of these soluble substances goes into solution within a comparatively short time.

Molasses Analyses.—From year to year E. SAILLARD publishes analyses of final factory molasses, and his results are interesting for comparison. Here are his figures for four samples taken from a French factory[1] during 1930-31 at intervals from November 29th to February 6th.:—

[1] *Berichte*, 1881, 34. [2] *Zeitsch. Zuckerind. Czechoslov.*, 1931, 55, No. 24, 287-292.

	Sample 1	Sample 2	Sample 3	Sample 4
Direct polarization	50·33	50·62	49·85	50·67
Sucrose by Clerget	48·57	48·53	47·20	47·69
Reducing Sugars	None	None	None	None
True dry matter	76·37	76·75	76·00	74·62
True purity	65·90	65·90	65·59	67·90
Sulphated ash × 0·9	9·12	9·26	9·09	8·41
Saline quotient	5·51	5·46	5·48	6·01
Organic matter : Ash	1·85	1·82	1·87	1·85
Coloration	1·20	1·19	1·08	1·26
pH	7·40	7·30	7·30	7·20
Nitrogen	1·73	1·61	1·58	1·35
Lime (as CaO)	0·07	traces	0·15	0·19
Organic matter per unit of nitrogen	9·78	10·47	10·79	11·51

It is seen that the difference between direct polarization and sucrose by Clerget increased gradually through the campaign, viz., from 1·76 to 2·98, probably due to the formation of raffinose which occurs in the latter part of the season when the roots are subjected to bouts of extreme cold. The nitrogen per 100 of dry matter gradually diminished; whereas the organic matter per unit of nitrogen gradually increased. All four samples were slightly alkaline, their *pH* being just above 7. Judging from the saline quotient, the samples do not appear to be thoroughly exhausted.

MISCELLANEOUS.

Behaviour of Sugar-Soluble Silicic Acid in Solutions of different Alkalinities. O. Spengler and A. Traegel. *Zeitsch. Ver. deut. Zuckerind.*, 1930, 80, 847-852. Carbonatation experiments are described showing the amount of soluble SiO_2 remaining in solution under different conditions of alkalinity. For example, a beet juice, to which sugar-soluble silica had been added, having a natural alkalinity of 0·031 per cent. CaO gave a first carbonatation juice containing 2 mgrs. of SiO_2 per 100 c.c. and second carbonatation juice containing 8 grms. SiO_2. Juices, the alkalinity of which is due to lime, retain much less silica in solution than those in which the alkalinity is mainly due to alkali carbonates. *Decomposition of Alkaline Sugar Solutions at High Temperature.*—O. Spengler and J. Ost. *Ibid.*, 1930, 80, 751-770. Solutions containing 15, 30 and 50 per cent. of sucrose and 0·15, 0·25, 0·40 and 0·50 per cent. of lime were heated in a closed iron vessel at 110, 120, 130 and 140°C. for 20 to 90 min. Results showed the pol. of solutions at constant temperature to fall in direct proportion to the time, the alkalinity at the same time diminishing, and acidity sometimes setting in. Colour increased notably as neutrality was attained, becoming lighter when acidity was reached. Regarding the rôle of temperature, with solutions of certain alkalinity and sucrose content, an increase of 10°C. was found to treble the rate of decrease of pol. and alkalinity and the rate of increase of colour. *Storage of Raw Beet Sugars.* O. Spengler and S. Böttger. *Ibid.*, 1930, 80, 690-709. Raw beet sugar with a moisture content of 2 per cent. will retain both moisture content and affining qualities practically unaltered at ordinary temperatures provided the relative humidity is kept at 50 to 60 per cent. But in air of lower r.h. they lose moisture and give darker sugars on affination. Stored in the presence of air of over 60 per cent. the sugars alkalinity fell within three weeks, invert sugar being formed. In the case of white beet sugar, the best r.h. is about 60 per cent.

[1] *Circ. hebd.*, No. 2193.

FARREL-BIRMINGHAM COMPANY INC.

351, Elizabeth Street, ANSONIA, CONN., U.S.A.

SUCCESSOR TO

FARREL FOUNDRY & MACHINE CO. (Est. 1848)
BIRMINGHAM IRON FOUNDRY (Est. 1836)

Representatives :

E. H. THOMAS, Manager New York Office, 79 Wall Street, New York City.

FRANK L. ALLEN, Aguiar 73, Havana, Cuba.

ENRIQUE ABARCA, San Juan, Porto Rico.

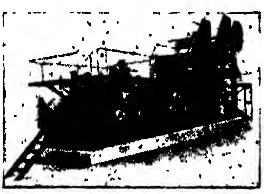
MAX W. BOLEY, Calle Alsina 743, Buenos Aires, Argentine.

AYRES & SON, Avenida Rio Branco, 76, Pernambuco, Brazil.

EDWARD J. NELL CO., 680 Dasmarinas, Manila, Philippine Islands.

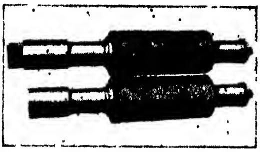
FARREL SUGAR MACHINERY:

Cane Grinding Mills; Single, Double and Multiple Crushers; Gear Drives for Mills and Crushers; Cane Knives; Cane Levellers; Cane Carriers; Intermediate Carriers; Juice Strainers and Trash Elevators; Rolls (complete); Roll Shells; Hydraulic Pressure Regulators; Hydraulic Accumulators; Speed Reduction Units; Cast Tooth, Cut Spur and Cut Double Helical Gearing; Repairs of all kinds.



Farrel Cane Mills and Crushers:

Built in single, three-roller mills or in tandems of six, nine, twelve, fifteen or more rolls with or without a crusher. Massive, well proportioned housings with metal disposed to best advantage; improved hydraulic cap of simple construction with removable cylinder having only one packing; crown wheels with specially designed teeth to give maximum variation of roll centres. Accessibility and interchangeability of parts a particular feature. Used by leading sugar producers in all parts of the world.



Farrel Rolls:

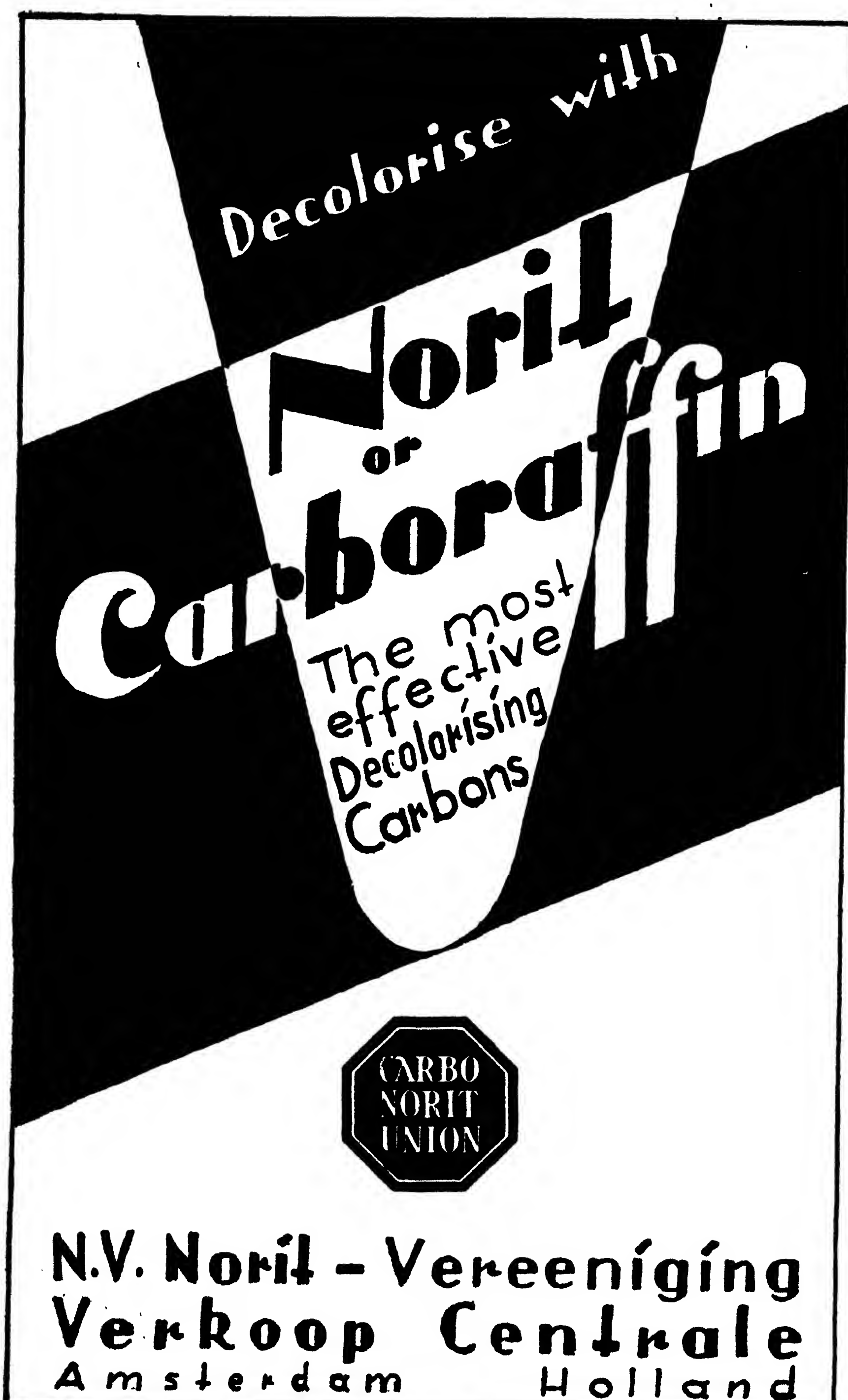
Made of a mixture of metals, which produces a hard iron of very open grain, demonstrated to be the most satisfactory by over fifty years' experience and hundreds of rolls in successful operation. Texture and quality of iron in roll shells a factor in obtaining high extraction and tonnage. Method of construction a positive prevention of shells becoming loose on the shaft.

Farrel Revolving Cane Knives:

For shredding and cutting any kind of cane, making a compact blanket which provides more uniform feed to the crusher. Made with specially shaped knives having serrated edges (patented) which increase shredding action. Expand mill capacity and raise sucrose extraction. Arranged for electric motor, engine or belt drive. Maintenance cost is negligible.

Engineering Data, Specifications and Quotations on request.

NEW RECORDS FOR PRODUCTION AND PRECISION ARE MADE ON FARREL-BIRMINGHAM MACHINES.


Decolorise with
Norit
or
Carboraffin
The most effective Decolorising Carbons
CARBO NORIT UNION
N.V. Norit - Vereeniging
Verkoop Centrale
Amsterdam Holland

Department of Overseas Trade Reports.

BELGIUM.

According to the Annual Report on the Economic Conditions of Belgium issued by the British Commercial Secretary at Brussels,[1] some 55,567 hectares were under sugar beet cultivation in 1930, as compared with 57,756 in 1929 and 70,645 hectares in 1927. The average weight of the root this year was the highest since 1922, but the sugar content, averaging between 14 and 16 per cent., was about 2 per cent. lower than that registered in 1929. Comparative figures are as under :—

	Grammes. 1929	1930
Average weight of root..............	360 ..	377
,, ,, leaves	571 ..	784
,, sugar content	14·80%	13·80%

According to analyses at the end of September it is estimated that the yield as regards weight will be superior to that of 1929 by about 6000-7000 kg. per hectare. With an average of 60,000 plants to the hectare, this year's yield may be taken as varying between 23 and 35 metric tons per hectare. Wages for planting were 350 francs, with board, and 450 francs, without board per hectare. In some districts 725 francs per hectare were paid for pulling, topping and loading with, in addition, free potatoes, lodging, beer and light. To this had to be added 30 francs payable to the employment agent for each labourer engaged. The cultivation of sugar beet in Belgium is steadily decreasing where communications are difficult or slow. At Dinant, Eghezee, Gembloux and the surrounding districts, noticeable decreases are recorded.

On the whole growers have experienced a very bad year. Sales of their products to the sugar factories are reported to have been distinctly unremunerative and they complain of heavy losses. Some growers only obtained 146 francs per ton for last year's beets with sugar content of 16 per cent., whereas the contract price was 160 francs. World over-production of sugar and protectionist tariffs overseas are stated to be the root causes of the present crisis in this branch. The average cost of production per ton of beet fluctuates around 181 francs, but factories offered 100 francs and less for this year's produce. With an average of 32 tons to the hectare, at this rate, the losses are estimated at approximately 2500-2880 francs per hectare.

The export of a percentage of the Belgian sugar production is viewed with disfavour by growers because this export trade is taken into account when contract prices are established for beets delivered to factories. It is estimated that world prices leave a 50 per cent. loss on production costs. If, in Belgium, the crop area was decreased until it was just sufficient to supply the needs of the home market, growers assume that they would obtain a better return. The Government has now taken measures for the protection of this industry.

On the other hand it is interesting to note the discovery of a new process for making cattle food-cake from the complete sugar beet instead of from the factory pulp wastage. It is claimed that the application of this process would materially benefit growers and cattle stock breeders. Potash and soda residues, which constitute from 8-12 per cent. of the root, and which have hitherto disqualified to a certain extent sugar beet pulp as cattle food, would be practically eliminated by the new process, whereas the whole of the nutrient sugar content would be retained. The new cattle food, it is claimed, could easily compete with current products both as regards price and quality. It is also important to note that according to an authoritative estimate the

1 "Economic Conditions in Belgium in 1930." H.M. Stationery Office, London. 4s. 2d. post free.

yield of one hectare of fodder beet, root and leaves, taken at 22 tons leaves and 22 tons roots, is sufficient for the maintenance of eight head of cattle for a period of six months.

DENMARK.

The 1930 results of the Danish sugar factories have not yet been published but it is believed that the final figures will be more favourable than was anticipated earlier on. The crop was of satisfactory quality, and the area under cultivation increased from 29,900 hectares in 1929 to 32,100 hectares in 1930. The total weight of beets treated reached 1,030,000 metric tons (798,000 metric tons in 1929), and the output of refined sugar about 170,000 tons (134,300 tons). The average cost of the beets to the factory, including bonus and all extras payable to the growers, amounted to Kr. 1·97 per 100 kg. in 1929. The corresponding 1930 rate has not yet been calculated, but is expected to be somewhat below the 1929 level. The factories imported some 18,900 metric tons (16,900 tons) of raw sugar for refining. The retail price of granulated sugar dropped from 32-33 öre per kilo at the beginning of the year to 28-29 öre in December.

When the factories came last season to contract with growers for the supply of beet they found that certain guarantees were necessary with respect to the price to be paid for the roots. There was, otherwise, a prospect of a serious shrinkage in the cultivated area, farmers having been dissatisfied with previous results. To prevent this the factories provided a special fund of Kr. 800,000, which the Government undertook to augment, if necessary, with a maximum subsidy of Kr. 1,200,000, towards increasing the price of the roots, in so far as this fell below Kr. 2 per 100 kilos. Developments have necessitated the use of the total fund and subsidy.[1]

POLAND.

Sugar.—The fall in prices on the world market reacted unfavourably on the Polish sugar industry, which depends largely on exports. Faced with these difficulties, the Polish sugar convention decided at the beginning of the year to reduce production and to diminish the area of beet plantations.

The production of white commercial sugar in the 1931-32 season is estimated at 710,000 tons, as compared with 824,000 (final returns) in the preceding year; as local consumption should be in the neighbourhood of 345,000 tons, there will remain for export approximately 365,000 tons; last year's exports amounted to 400,000 tons. The internal wholesale price for white commercial sugar has been fixed at 104·50 zlote per 100 kg. parity Poznan; an additional charge of 3·15 zlote is made for the sack, and the excise amounts to 38·50 zlote.

The foreign financial assistance, which this branch of industry has now received for a number of years, has been extended to the current year.

The Polish quota in the proposed international sugar convention will amount to 308,000 tons of raw sugar, or 277,000 tons of white commercial sugar. It is less than was originally expected but, on the whole, the industry would appear to be satisfied with this contingent, as it is realised that the quantitative sacrifices will be compensated by financial advantages through an increase of price. With the convention concluded, the position of the Polish sugar industry, which has already been strengthened by last year's curtailment of production, should further improve.[2]

[1] From "Economic Conditions in Denmark" (February 1931). Report by the Commercial Secretary, H.M. Legation, Copenhagen. H.M. Stationery Office. 2s. net.

[2] From "Economic Conditions in Poland," 1930. H.M. Stationery Office, 1s. 6d. net.

Publications Received.

Report on the Sugar Beet Industry at Home and Abroad. Economic Series No. 27; Ministry of Agriculture and Fisheries. (H.M. Stationery Office). 1913. Price: 6d.

Every aspect of the sugar beet industry in Great Britain is covered by this report, which has been prepared by Mr. ALFRED WOOD, jointly with Mr. J. H. GORVIN, of the Markets Division of the Ministry. More than half of it is taken up with a detailed treatment of the technical and economic aspects of both the agricultural and the factory sides. Chapters of particular interest are those giving figures for production. At last figures are available for the cost of production of beet sugar in this country, and these are contrasted with foreign data. Further on, the external relations of the industry and those of grower and factory with each other form a separate section. Here the questions of sugar taxation and State assistance are discussed, and it emerges that the cost of the industry to the State in the form of subsidy and rebate of taxation has been almost 30 million pounds during the past seven years. A final chapter presents a brief review of the progress and prospects of the industry, and emphasizes the necessity for the industry to tackle certain internal problems before the subsidy goes altogether in 1934. Chief among these, it is said, is that of reconciling the purely home-grown sugar interests and the purely refining interests in this country. Reference is made to the suggestion that the best hope for the future lies in the unification of all sugar interests in this country, both manufacturing and refining, accompanied by satisfactory safeguards for the sugar-beet grower, and the observation is made that " it would then be a question whether in negotiating beet prices any advantage would be gained by replacing the method of collective bargaining, which has previously been adopted and is only concerned with price-fixing, by a more compact system of collective purchase and sale, in which the contracting parties would be an all-in combination of factories on the one side and an all-in marketing organization of beet growers on the other."

Industrial Chemistry. Emil R. Riegel, Ph.D., Professor of Physical and Industrial Chemistry, University of Buffalo; with the support of a large number of collaborators. (The Chemical Catalogue Company, New York). Price: $9·00.

This book has as its purpose the presentation in a single volume a picture of the numerous commercial activities which make up industrial chemistry. It is based on up-to-date information obtained in the course of professional work in American plants by visits and interviews and by collaboration with experts. Such a carefully written book should form not only an excellent textbook for students, but should prove of use to the practising chemist in giving him information on the rapid changes that are taking place around him in different branches of chemical industry, the significance of which is sometimes difficult to appraise from the perusal of periodical literature. Methods of producing synthetic motor fuel, which threaten an effect on the fermentation alcohol situation, form an example of such a change. Altogether there are 50 chapters, dealing with practically every important manufacture from sulphuric acid to cerium; four of them treat of chemical plant; one of control instruments; and one lastly of patents.

Colloid Chemistry: Theoretical and Applied. By selected International contributors; collected and edited by Jerome Alexander. Volume I: Theory and Methods. (The Chemical Catalogue Company, Inc., New York). Price: $14.50.

This is the most comprehensive of all the numerous books published on the subject of colloid chemistry, being in fact the work of 60 different writers, all of them recognized authorities in their respective spheres. There is much to be said for this method of presenting a subject, though of course there are disadvantages in giving such a variety of views without exposition or comment. These essays, each an entity in itself, will nevertheless be read generally with much interest, in spite of certain overlapping. Sir Wm. BRAGG writes on " Cohesion and Molecular Forces "; E. FRANKLIN BURTON on " Determination of Size and Mass of Colloid Particles "; HERBERT FREUNDLICH on " Adsorption and its Significance "; EINSTEIN on the

"Theory of the Opalescence of Homogeneous Liquids in the Vicinity of the Critical State"; MAX POSER on "Ultramicroscopy"; H. BECHHOLD on "Ultrafiltration" and RICHARD ZSIGMONDY on "Membrane Filters and their Uses." A volume on the same lines covering the Technology of Colloids is projected.

The Memoirs of Père Labat. Translated and abridged by John Eaden; with an Introduction by Philip Gosse. (Constable & Co., Ltd., London). 1931. Price: 7s. 6d.

PÈRE LABAT sailed from Marseille in 1693 to take up missionary duties in the French West Indies, and returned in 1705 after having visited other of the West Indian islands. Before he died in 1738, he completed 8 volumes of travels and experiences.[1] His name is known to us by reason of the very full account which he has given of the sugar industry of his day. A skilled engineer, he published plans of 17th century cane factories, and stated details of the processes of cultivation and manufacture then employed.[2] Heretofore these writings of the French missionary, so full of varied experiences, have been difficult to procure; and it seems remarkable that in spite of their great interest a translation into our language should not previously have been published. Now, however, as a step towards remedying this, a much abridged English edition has been prepared by Mr. JOHN EADEN, who, so far as the missionary's travels is concerned, has extracted the cream of the eight volumes. His pages reveal vividly the West Indian life of that day, and tell stories of filibusters and feuds, fightings and captures, and many adventurous incidents. Not least do they reflect the remarkable personality of PÈRE LABAT, his good fellowship, his wit, and throughout his great power of observation. It is a delightful book, the reading of which no one can fail greatly to enjoy.

Annual Survey of American Chemistry. Volume IV. Edited by Clarence J. West, Director, Research Information Service, National Research Council. (Chemical Catalogue Company, Inc., New York). 1930. Price: $4.00.

A succinct and critical survey of the work of American chemists in different fields cannot fail to be of service not only in that country but also abroad, especially to those endeavouring to obtain a rapid review of progress in fields not their own. This volume provides this for the period July 1st, 1928 to December 31st, 1929. It contains chapters on subjects related to our industry, as Carbohydrates, Foods, Water, Soils and Fertilizers, Fermentation, etc., which contain information of value to those desiring to keep abreast of technical progress.

Formation and Properties of Boiler Scale. Everett P. Partridge. Engineering Research Bulletin No. 15, June, 1930. University of Michigan, Ann Arbor, Mich., U.S.A. Price: $1.00.

Contents: Thermal Effects of Boiler Scale. Constituents of Boiler Scale. Formation of Boiler Scale Method of Scale Prevention. General Summary of Contents. Appendices.

A Experimentação Agricola nas Indias Neerlandezas e a Cultura da Canna de Assucar e a Industria Assucareira na Ilha de Java. Adriao Caminha Filho. (Ministerio da Agricultura, Industria e Commercio, Servico de Informacoes, Brazil) 1930.

A very complete illustrated account is here given by the Director of the Campos Sugar Experiment Station of the methods followed in Java in cane cultivation, and the methods used to obtain seedlings.

---

1 "Nouveau Voyage aux Iles de l'Amerique." Par le Père JEAN-BAPTISTE LABAT. MDCCXXII Paris. It was published originally in Paris in 1722, an edition in 8 volumes appeared in 1742, one volume of which was devoted to cane cultivation and sugar manufacture.

2 JONES and SCARD in "The Manufacture of Cane Sugar," reproduce one of these drawings.

Brevities.

British Empire Producers' Organization.—With the death of Lord Melchett (formerly Sir Alfred Mond) the B.E.P.O. lost an influential Chairman. Sir Edward Davson, Bart., has now been elected to succeed him, and the Organization will thus have the benefit of the experience of one of the leading lights in the British sugar world.

Sugar Analysis Commission. — It was recently[1] announced that the next meeting of the International Commission for Uniform Methods of Sugar Analysis would take place in September of this year in Amsterdam. Now, however, in order to give more time for the consideration of the many subjects which are before the Commission, it has been arranged that the meeting shall be postponed until 1932.

Java Molasses Utilization.[2]—Of the 8,741,537 quintals of molasses turned out by Java factories during 1930, 80·22 per cent. was exported; 11·92 per cent. used in spirit factories in Java; 3·86 per cent. was hardened; 0·34 per cent. was burnt; 0·25 per cent. was used for the preparation of caramel; and 1·01 per cent. was used as fertilizer, or mixed with irrigation water; the balance of 2·40 per cent. being used in different other ways not specified.

"Sumacarb" Plantation Refining.—Trials were recently carried out in a white sugar factory in Kenya on refining using "SumaCarb" decolorizing carbon and layer filtration. These tests were entirely successful in demonstrating, what is current practice in certain refineries in other countries, viz., that starting with plantation white sugar it is possible by this means to produce a faultless refined sugar at a low cost without revivification and by an easy process requiring easy supervision.

Fiji Flood Damage.—For the second time within 18 months Fiji had the experience of a severe hurricane during the 1930 sugar crop season, when the rainfall was excessive and in the mountains had a total fall in a week of 96 in. The resulting floods reached a level much above all previous marks, washed away dwellings and caused a considerable loss of life. The damage to the canefields was however not heavy, and it is hoped that the 1931 crop will not be seriously reduced in extent.

European Beet Crop Prospects.—F. O. Licht's estimate at June 30th remains unchanged from that of April 30th, at 1,607,000 hectares without Russia, and 2,989,000 hectares including Russia. Crops on the whole are recovering from the earlier bad weather and are not unsatisfactory, save in Slovakia where damage from pests and from dry weather has seriously affected the outlook. In Holland the beets are described as "rather good," but the sowings this year are only 36,917 hectares, as compared with 57,462 hectares last year.

The English Beet Crop.—From a reliable source it is estimated that the coming English beet crop will be reduced by some 35 per cent. The excessively cold and wet spring has resulted in patchy growth, but if the weather conditions are more favourable between now and the harvest, the crop may provide an average yield. This is the more likely owing to the fact that the lower prices ruling for sugar have caused many of the inefficient growers to abandon their crops this year, thus leaving the field to the older and more experienced ones.

"Easifilt" Filter.[3]—This is an enclosed vertical leaf-filter. It consists of a number of leaves arranged in a chamber consisting of two clams having a single vertical joint. Liquid to be filtered is pumped into this chamber, the cake building up on the leaves, while the filtrate passes through internal drainage channels to the outlets at the top of the apparatus. The cakes are readily washed, may be dried by vacuum, compressed air or steam, and are easily discharged after drawing out the leaf battery, or by sluicing. This filter combines conditions favourable to high rates of filtration; is flexible in operation; and occupies a relatively small floor space. Tests are said to have shown it to be an eminently satisfactory and successful apparatus which should be of much interest in sugar factory and refinery work.

---

1 *I.S.J.*, 1931, 306. 2 *Archief.*, deel III, Mededeelingen, 1931, No. 3.
3 It is made by Manlove, Alliott & Co., Ltd., of Nottingham, who will supply particulars.

SUGAR BAGS.—An air-proof and water-proof bag has recently been put on the market which may be of service in the sugar industry. It is a strong jute lined with tough water-proof paper. This is closed with a special double-wire tier, thus making a packing which is practically hermetical. Sugar stored in such a bag should certainly be much less affected by atmospheric changes compared with packing in ordinary bags.

RUBBER-LINED TANKS.—An emulsion of rubber is being used for the lining of iron vessels in chemical industries ; and the most recent development of this advance for facilitating its application is to spray the liquid upon the surface in thin films with a short drying interval between each. Or the liquid may be painted on. Such a method of preventing contact between sugar liquor and iron surface may be of distinct interest in white sugar factories and refineries.

COLOUR MEASUREMENT.—The Hilger " Blancometer " employs a photo-electric cell, and is specially adapted for measuring colours approaching white or small differences between shades. It employs a standard on a sliding tray on which is also placed the comparison specimen, reflected light from which falls on a p.-e. cell, connected to a Linderman electrometer. By adjusting the position of the photometric wedges over this last until the same reading is obtained on the electrometer with it as with the standard, a measure of the difference of the two specimens is obtainable.

" CERELOSE."—We recently published some particulars of the refined starch glucose which is sold under the name of " Cerelose," and is making a bid in the U.S.A. to oust ordinary sugar in the canning, confectionery and other industries.[1] To-day it is selling in New York at \$3.75 per 100 lbs. for the product containing 8 per cent. of water, and at \$4.25 for the anhydrous material. Its sale has received a fillip from the recent ruling of the U.S. Department of Agriculture that it may be sold without the statement on the label of its presence, as formerly was necessary.

MOLASSES STANDARD.—The Molasses Committee of the New York Coffee and Sugar Exchange now propose to define the grade deliverable as " Any merchantable cane blackstrap molasses testing at the time of storage in licensed tank not less than 43° Baumé at 63·5°F." Hence the Bé. minimum is raised from 42 to 43°, and the specification relating to the minimum total sugars is eliminated. By eliminating the total sugar content requirement, the warehouse will no longer demand the high specification on initial storage, and the storage charges will be correspondingly reduced, and a large quantity made available for delivery.

ALGAE FORMATION AND " E.C."—In condenser and filtration plant, trouble is frequently experienced due to the formation of algae in outlet pipes, the bore thereby being so reduced as to cut the flow in half and sometimes even choke it entirely. Certain overseas factories have easily and economically overcome this by treating the water concerned with "E.C." at the rate of something like 1 part to 10,000 of water. This means free chlorine at the rate of about 1 part per 1,000,000 of water. All organic growth has at once been arrested, and at a negligible cost. No damage to pipes or tanks by the chemical has been detected. Some good reports have also been received on effluent treatment by this means.

CO_2 PORTABLE INDICATOR.—A piece of apparatus which should appeal to factory managers as a very useful aid in controlling the economical combustion of bagasse so as to limit the amount of extra fuel consumed, or eliminate it entirely, is the " W. R. Portable CO_2 Indicator." It is not dissimilar in size and appearance to a miner's lamp. Its use is simplicity itself. It is connected to an iron sampling tube reaching into the flue ; the flue gases are pumped through the instrument by a few puffs with the rubber aspirator, and this continued till the CO_2 per cent. shown on the dial registers a permanent maximum figure. Anyone in this way can make a CO_2 determination comparing in accuracy with the Orsat laboratory apparatus. Such determinations made at intervals ensure the control of the CO_2 in the flue gases, the importance of which in bagasse fuel economy is obvious. Many hundreds of these apparatus are in use in a great variety of furnace plants in the U.S.A., the U.K., and elsewhere, and they should be found a boon in cane sugar factories.

[1] *I.S.J.*, 1931, 198.

Review of Current Technical Literature.[1]

Colour and Quality in Cuban Raws. **E. W. Rice.**[2] *Facts about Sugar*, 1931, 26, No. 5, 214.

In a previous paper,[3] it was indicated what great differences may occur in the composition of the organic non-sugars in the case of 96° raw sugars, and that these discrepancies would show the necessity for several tests to be made on each proposed purchase of raw sugar to satisfy one of its quality. Throughout 1929 the tests summarized below were made on every mark of Cuban raw received over 1000 bags, and were made on 56 samples. In order better to study these figures, they were grouped in different ways, as shown. While large variations may be found between the individual results, the tests extending over a year indicate that widely differing results are uncommon. The tabulated averages are very consistent, with the exception of the Elliot filtration rate in the group according to date of receipt. All undesirable qualities increase or decrease together. If the colloids are high, the colour will also be high, and the filtration rate will be low, each among the results of poor defecation. As the year progresses, the sugar does not become better; also the sugar becomes poorer as one approaches the eastern end of the island.

It wonderfully simplifies production and purchasing if the quality may be judged by one simple factor such as colour.

Average According to Date Received.

	Pol.	Dye No.	Elliot Filt.	Peter's Units. Green.	Peter's Units. Blue.	Q Ratio.
1st 19 lots	96·9	264	49·3	163	505	309
2nd 19 lots	96·6	271	58·9	168	558	330
3rd 18 lots	96·6	302	44·2	218	726	332

Averages According to Dye Number.

	Pol.	Dye No.	Elliot Filt.	Peter's Units. Green.	Peter's Units. Blue.	Q Ratio.
1st 19 lots	96·7	215	61·1	138	449	331
2nd 19 lots	96·7	275	48·8	186	584	314
3rd 18 lots	96·6	352	42·4	226	757	326

Averages According to Colour.

	Pol.	Dye No.	Elliot Filt.	Peter's Units. Green.	Peter's Units. Blue.	Q Ratio.
1st 19 lots	96·8	240	57·8	118	376	322
2nd 19 lots	96·8	274	50·3	177	552	312
3rd 18 lots	96·4	326	44·3	256	868	338

Averages According to Provinces.

		Pol.	Dye No.	Elliot Filt.	Peter's Units. Green	Peter's Units. Blue.	Q Ratio.
Pinar del Rio	1 sample	96·8	280	58·4	145	476	328
Havana	1 „	96·7	275	64·4	158	575	323
Santa Clara	23 samples	96·7	249	59·6	158	523	333
Camaguey	10 „	96·9	288	52·0	186	579	306
Oriente	21 „	96·6	309	40·0	209	685	321

Report on Standardization of Chemical Control Methods in Cuba. **J. M. Santos.** *Proceedings of the Fourth Annual Conference of the Association of Sugar Technologists of Cuba*, 1930.

A Committee, consisting originally of Dr. Horne, Dr. Saladin, Mr. Lee G. Camp, request all members of the Cuba Sugar Club to modify the factory reports of mills under their charge in accordance with the resolutions of the International Society, briefly as follows: (1) Standardization of the terms used in factory Reports with their definitions. (2) Two methods of milling control, in which are necessary, in all cases, the direct determination of the weight of the cane, the weight of the mixed juice, the Brix per cent. of the mixed juice, the pol. per cent. of the mixed juice, the dry substance per cent. bagasse, the pol. per cent. bagasse, the Brix per

[2] National Sugar Refinery, Yonkers, New York. [3] *I.S.J.*, 1930, 271.

cent. last expressed juice and the pol. per cent. last expressed juice. One of the methods is based on the determination of the imbibition water by actual weighing and the other by the direct determination of the fibre per cent. cane. (3) The weight of the cane and mixed juice be determined by weighing; when this is not possible, that the method used for calculating them be stated in the report. (4) All methods of milling control, to be exact, require the actual weighing of the bagasse and that as long as this is not possible, one of the above mentioned methods of control be used, stating clearly which of these methods has been employed. (5) Complete elimination of the term Normal Juice, because of the confusion it has created, and the adoption of DEERR's term Absolute Juice. (6) All reports to show: Extraction Ratio, Milling Loss, Undiluted Juice in Bagasse per cent. Fibre, the figures used to judge of mill work for the purpose of making comparisons during various crops and in different countries, thus to determine which of them is best suited to that end. (7) Use of the metric decimal system to facilitate comparing data, standardizing the system of weights and measures. (8) All sugar mills in all countries publish complete information regarding their milling equipment. (9) Recommend a study of the figures which express results obtained, on the basis of a pre-determined maximum figure such as the ideal values of DEERR, or the normal values used in Java, or a similar method. (10) Recommend a further investigation of the figures representing mechanical milling performance, such as grinding coefficient, tonnage ratio and tonnage fibre ratio.

FILTRABILITY OF RAW CANE SUGARS. **J. C. Keane and H. G. Hill.**[1] *Industrial and Engineering Chemistry*, 1931, **23**, No. 4, 421-427.

I.—Effect of Factors prior to Pan-Boiling.—Data were obtained indicating that filtrability of syrup and sugars is influenced primarily by finely suspended material, part of which is probably in the upper range of colloid size while the remainder is probably somewhat above the upper limit of colloid dimensions. A large portion of this material may be eliminated by good defecation and proper handling of the muds. That suspended matter is a factor in the filtration rate of sugars was confirmed by the effect of pulverizing. For good defecation it is necessary to have effective manipulation of the proper equipment, and also to have a raw juice containing sufficient available phosphate to form a flocculent precipitate with the lime. The muds should be carefully filtered, and if any juice is decanted from the mud tanks before filter-pressing, this juice should be further treated and not sent direct to the evaporators. However, judging from the good filtrability of filter-press juice, it would seem advisable to send this directly to the evaporators whenever good filtration gives a brilliant juice. Addition of phosphate to the raw juice in the form of phosphoric acid will aid defecation and in turn improve the filtrability of the resulting sugar when this constituent is deficient in available form. The advisability of its use from an economic, as well as an operating, standpoint must be decided by each factory.

II.—Effect of Pan-boiling Operations.—This part of the investigation showed that (1) a good filtering syrup is necessary in order to make a sugar of good filtrability; and (2) a poor filtering sugar may result from a good filtering syrup when pan construction or operation is faulty. The effect of inefficient pan work is more pronounced in the case of second sugars. Other investigators have found that variations in systems of boiling affect the filtrability of raw sugar produced. Although the data given here show that the coil pans under observation yielded a decidedly better sugar than that obtained from the calandria pans, this behaviour does not necessarily apply to calandria pans in general, as it is very probably due to defects in design or operation of the particular pans investigated. Either of these factors may influence the quality of the resulting sugar, and adverse results are largely due to deficient pan circulation. Pan circulation does not refer merely to time of boiling or rate of evaporation but primarily to the manner in which the total mass of crystals is kept in constant motion, bringing individual crystals continually in contact with supersaturated mother-liquor and thus producing more complete sucrose crystallization and probably reducing contamination of the sugar crystals. The specific effect that various con-

[1] Carbohydrate Division, Bureau of Chemistry, Washington.

ditions of boiling may have on the resulting sugar is to be studied further, not only from the standpoint of filtrability of raw sugar, but also from the standpoint of crystallization in general. Hence there are two prevalent and distinct causes of poor filtration of raw cane sugar : one is poor juice clarification and the other is faulty sugar-boiling operations. Each of these in turn involves a number of different factors.

Report of the Queensland Sugar Technologist for Year Ending October 30th, 1930. **Norman Bennett.** *Bureau of Sugar Experiment Stations Report.*

Figures for 24 Australian mills, excepting those of the C.S.R. Co., and Pioneer, Eagleby and Alberton, for the 1929 season are given as below :—

Tons cane ground	3,581,709	Gallons Molasses p.t.c.	4·34
Tons 94 nett titre sugar made	518,516	Sugar—	
Net titre of sugar	97·29	Pol.	98·41
Tons cane per ton sugar	6·91	Moisture	0·398
Fibre in cane	12·5	Tons Fuel—	
Pol. in cane	15·65	Wood	67,643
Bagasse—		Coal	17,687
Moisture	51·99	Molasses	12,573
Pol.	3·02	Extraction	94·55
Purities—		Extraction Ratio	0·436
1st Expressed Juice	89·57	Milling loss	6·83
Clarified Juice	89·07	Pol. in sugars—	
Syrup	88·49	Per cent. Pol. in Cane	87·45
Brix Syrup	68·17	Per cent. Pol. in Mixed Juice	92·49

The tons of cane per ton of sugar recorded is the lowest on record, the figures for the previous three years having been 7·17, 7·32 and 7·52. It has now also been possible to reduce the figures for wood and coal. A closer control of the manufacturing process is stressed, and it is recommended that weighing or measuring appliances for mixed juice, maceration water, final mud and final molasses should be installed. Two mills have recognised this fact, and these are to put in the Boulogne automatic weighing machines for the final molasses.

The Determination of Small Proportions of Invert Sugar in Raw Sugars. **Lewis Eynon and J. Henry Lane.** *Journal of the Society of Chemical Industry*, 1931, **50**, 85-86 T.

It has previously been shown[1] that determination of invert sugar in unclarified solutions of sugar products may be vitiated by two errors, viz., that due to reducing non-sugars precipitable by normal lead acetate, and that due to the presence of calcium salts. These two errors affect the result in opposite senses, but even their net effect may be serious in the case of low grade products such as molasses. For products of this kind a procedure was described according to which the solution is treated with normal lead acetate solution, which removes certain reducing non-sugars but no invert sugar, the filtered solution then being de-leaded and de-calcified with potassium oxalate solution and filtered again. The invert sugar content of the filtrate is determined volumetrically with Fehling's solution in presence of methylene blue as internal indicator. With raw sugars the two errors above mentioned are generally small, and their net effect is quite negligible, and either the incremental or standard titration method previously described[2] gives very accurate results with the untreated solution of such products. The invert sugar table given in that paper does not make provision for sugar samples containing less than 0·3 per cent. of invert sugar, but such cases are met by dissolving the material (25 grms.) with such a quantity of neutralized standard invert sugar solution that the whole, after being made up to 100 c.c. contains 0·1 per cent. of added invert sugar. The percentage of invert sugar in the sample is found by deducting 0·1 from the percentage of invert sugar in the

[1] *I.S.J.*, 1924, 107. [2] *I.S.J.*, 1923, 143.

solution, thus prepared and multiplying the remainder by 4. By working in this way, the determination of 0·1 per cent., or even less, of invert sugar is easily practicable, and the procedure is useful also in testing the purity of sucrose preparations intended for standardization purposes.

It is obvious that in determining small proportions of invert sugar by the above described procedure, the titration should be carried out as accurately as possible, since any error falls on the remainder left after deducting the added invert sugar. In view of this, it appeared advisable to examine the effect of lead clarification and de-calcification on the determination of invert sugar in raw sugars of low invert sugar content (less than 0·3 per cent.). To this end the invert sugar contents of three samples of raw cane and one sample of raw beet sugar were determined in presence of added invert sugar. In each case a 25 per cent. solution of the sample in 0·1 per cent. solution of invert sugar was made (*a*) directly, (*b*) after de-calcification with potassium oxalate, (*c*) after clarification with normal lead acetate and de-leading and de-calcification with potassium oxalate. From the percentage of invert sugar in each solution found by titration against 10 c.c. of Fehling's solution and reference to the table, 0·1 was deducted, the remainder multiplied by 4 giving the percentage of invert sugar in the sample. The results were as follows :—

Sugar	Polarization	Ash per cent.	Invert sugar content determination (*a*) per cent.	(*b*) per cent.	(*c*) per cent.
Raw sugar	98·7	0·30	0·176	0·194	0·189
Raw Cane	98·65	0·26	0·236	0·254	0·244
Raw Cane	98·75	0·20	0·254	0·272	0·260
Raw Beet	94·35	1·23	0·123	0·126	0·125

Apart therefore from the advantage of obtaining a lighter solution for titration, it is evident from the above results that clarification and de-calcification are unnecessary in the determination of invert sugar in raw sugar, even when the proportion of invert sugar is so small that the titration must be carried out in the presence of added invert sugar.

CLARIFICATION OF CANE JUICE USING PESPIN. **H. D. Lanier.** *Proceedings of the Cuban Fourth Annual Conference, Havana,* 1930. Further experience with the pepsin process[1] is stated to show that it results in a molasses containing 3·33 per cent. of undetermined organic matter, as compared with 10·2 per cent. without the treatment. The sugar made was " free from gums, of a higher filtration rate, and of a hard durable grain."—STUDIES IN FILTRATION. **J. P. M. van Gilse, P. J. H. van Ginneken and H. I. Waterman.** *Journal of the Society of Chemical Industry,* 1930, **49**, 444-446 and 483-490T ; 1931, **50**, 41-44T and 95-100T. After reviewing the work done by investigators on the different factors governing filtration, the authors discuss the formulae that have been proposed to express such conditions. None of these, however, is completely satisfactory, they say : " Without deprecating the value of these technical experiments, the filtration problem seems to us too complicated and to have been too little studied to enable filtration laws to be derived from technical experiments with liquids of varying composition."—RUM FERMENTATION. **Martin Ficker and Stefan Szûcs.** *Zentralblatt für Bakteriologie,* 1930, **82**, Nos. 8/14, 199-211. Rum fermentation differs from ordinary alcoholic fermentation by its longer duration, as well as requiring special yeasts which work in conjunction with acetic, butyric and lactic acid bacteria. That is when the flavour is to be developed naturally without the addition of some or other aromatic leaves, stalks, extracts, or the like. Grades of rum were produced from Brazilian molasses having a characteristic natural aroma arising solely from the activity of yeasts and bacteria. A fission yeast isolated from cacao beans, as well as the so-called Pombe yeast, both proved suitable, but wine yeasts from Brazilian sugar cane were less preferable, though they were vigorous fermenters, producing a spirit of less characteristic flavour. The fission yeast found in cacao beans could not be isolated from Brazilian cane, its juice, nor its molasses.

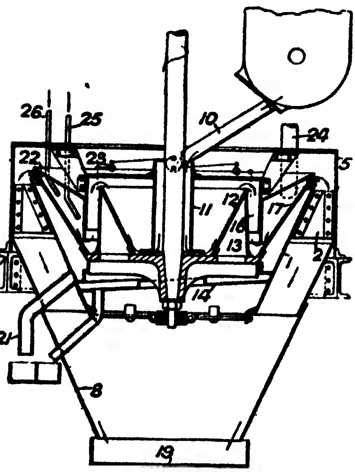
[1] *I.S.J.*, 1930, 488.

Review of Recent Patents.[1]

UNITED KINGDOM.

CONTINUOUS CENTRIFUGAL MACHINE.[2] **W. Zelezniak,** of **Krotoszyn, Poland.** 341,298. February 6th, 1930.

This centrifugal machine, for the separation of sugar and like materials from finely divided impurities, in which the sugar may be blued or otherwise treated, has a number of concentric conical sieves and partitions forming chambers through which the rejected material passes to tanks. The casing 1 of the machine is supported by brackets 2 from the cylindrical cover 5 fixed to the frame 4. The feed pipe 11 is arranged at the axis of the inclined perforated walls 12, 17 which are covered by metal sieves. The space between the screens is divided into chambers 13, 16. The material is supplied through the pipes 10, 11 and is thrown on to the screen 12. Rejected material passes through the sieve into the chamber 13 from which it drops to the slope 14 and passes thence to a tank. The retained material passes up the inclined wall 12 and falls to the bottom of the chamber 16 from which it is thrown upon the screen 17. The rejected material passes to the tank through the pipe 21 and the treated material passes over the edge of the screen 17 to the hopper 8 and conveyor 19. The thickness of the layer of material discharged over the screen can be varied by operation of the lever mechanism 23 to adjust the position of the conical ring 22. During the passage through the chamber 16, the material may meet a blueing agent and steam, the former being admitted through the pipe 25 and the latter through the pipe 26. The vapours are withdrawn through the pipe 24. Claim 1 reads: A method of separating sugar and other granular or like finely divided materials, wherein the materials being treated are subjected successively to a plurality of centrifugal separations in conical drums located concentrically in one centrifugal separator, the materials being separated in each drum and the rejected material being separately removed from each drum. This centrifugal machine is capable of working continuously, and is simple in construction. Little attention is needed, and 5 machines may be easily tended by a single operator. Its initial consumption of power is low, being about 12 h.p., while the average is 8.



***CANE HARVESTER. W. W. Groves** (communicated by **R. S. Falkiner and W. G. Charley,** of Melbourne, Australia). 345,950. December 30th, 1929.

In machines of the type described in Specifications 251,739, 284,683, 317,352 and 318,674, in which the cane is cut into short lengths or trashed, the trash is separated from the cut cane by repeatedly elevating and dropping the cut cane and trash through an air current. The cane is directed by pivoted dividers 11 to knives 3 on pivotally supported rotary discs 2 cutting at or below the ground level. The knives may be of the type described in Specification 339,618 [*Class* 6 (iii), Harvesting appliances]. Before the cane is cut by the knives its upper part is engaged by the edge of a hood 7 and the cane is thus caused, after cutting, to pass butt first between

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

[2] See *I.S.J.*, 1931, 242.

pairs of rollers 4, 5, 17, 18, or on a short elevator to a chaffing cutter comprising a disc knife 43 cutting on a curved and corrugated dead-plate 41. A roller 42 holds the cane on the dead-plate and the knife 43 is carried by a counter-balanced crank 44 rotated about an horizontal axis in a standard 46. The knife 43 may be positively rotated or may be merely free to rotate on its pivot in the crank. An oscillating plate pushes any cane carried by the knife to one side back into the main stream of the cane. The chaffed cane is carried by an elevator 52 to the separating devices comprising a drum

FIG. 1.

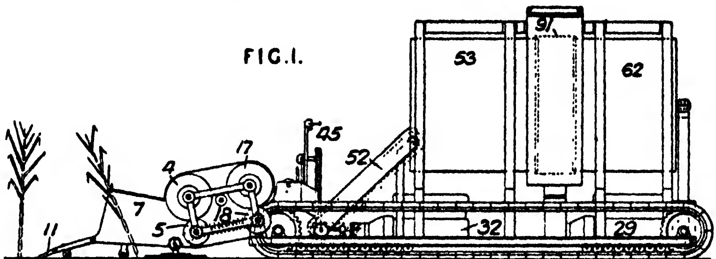


FIG. 2.

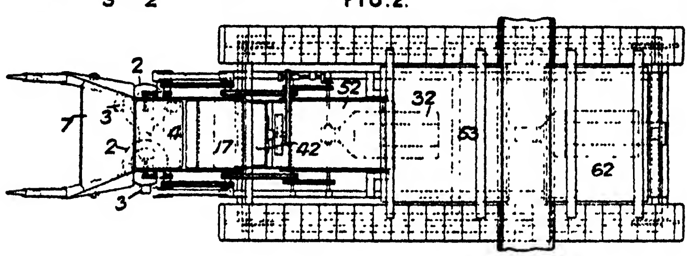


FIG. 5.

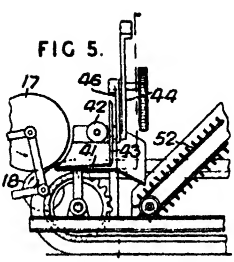
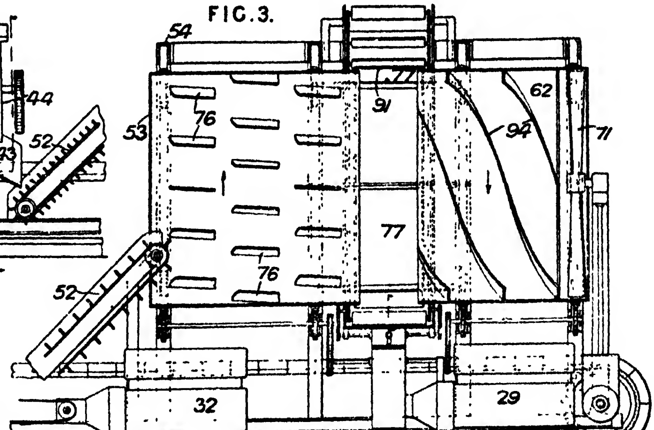


FIG. 3.



53 mounted to rotate in brackets 54. The drum is provided on its interior with helically arranged slats 76 that carry the cane and trash upwards and discharge it to be acted upon by a current of air drawn through the drum by a fan 71. The lighter trash is then drawn through the drum and discharged at the rear of the machine. The heavier cane is gradually worked by the slats 76 to a discharge space 77 situated between the drum 53 and a similar drum 62 preferably arranged to rotate in the opposite direction. The discharge space is covered by a hood 91 that is only provided with openings to permit the passage of an endless band conveyor which travels round a

frame arranged on the machine and carries the cut cane to carts. The air sucked in through these openings removes the last traces of trash from the cut cane being carried out on the conveyor. The drum 62 is fitted with vanes 94 arranged to move any good cane which reaches that drum back to the discharge space 77. The endless band tread devices supporting the machine are driven from a motor 29, which also transmits motion to the drums and the main conveyor; the cutting devices, rollers and conveyors for the cane and trash are driven from a separate motor 32.

UNITED STATES.

CANE SLICER AND LEVELLER. **Culbert J. Pender,** of Lautoka, Fiji Islands. March 24th, 1931. 1,797,673.

This invention consists in means for levelling and slicing the incoming matted mass of cane to prepare it for crushing. It is shown in Figs. 1 and 3. *A* is a shaft, *B* a hub thereon, *C* spokes radiating from the hub *B*, *D* two flat rings (or maybe discs) carried on the hub *B* and spaced apart about 8 to 9 in. when using knives about 12 in. long *E* are channel section bridges or knife holders which cross connect the rings *DD*, to which their flanges are rivetted. About eight such bridges spaced

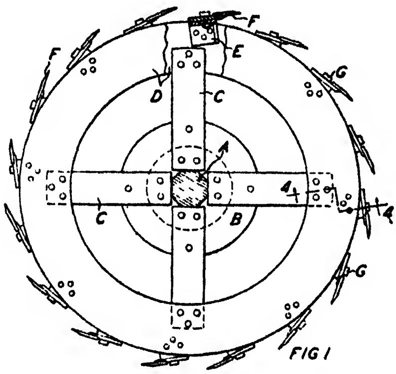


FIG 1

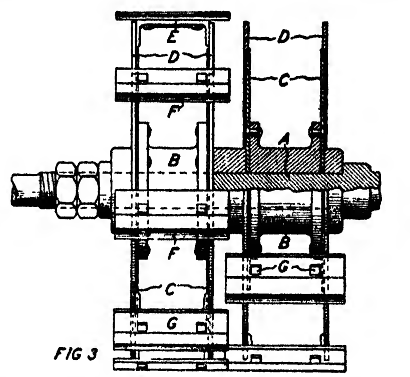


FIG 3

equidistant are fitted. The outside diameter measurement of the rings *D* is about 3 ft. more or less. On each of the bridges a knife is fixed by screw pins or any other means. The knives should be fixed demountably, as it is necessary to remove them from time to time for re-sharpening. The edges of the knives *F* set proud of the peripheral edges of the rings *D*, and the bolt nuts or stud heads *G* should set within the circle swept by the knife edges in order to prevent them from bashing the cane. The direction of rotation may be either positive or negative, but it is preferably negative—that is to say the cutters strike upwardly towards the incoming feed. An advantage is obtained by the negative drive, as, when it is operated short lengths of cane cannot be drawn underneath as when running positively, but are pushed backwards amongst the oncoming cane, and then as the mass comes forward they again encounter the knives. The device constituted of the requisite number of cutter heads with knives, mounted on a driving shaft, is an open skeleton structure through which the cane slices and fragments cut by the knives may pass freely. The majority of the cuttings are thrown forward towards the mill, others are thrown upwards and others backwards. The slices and fragments thrown backwards fall into the oncoming cane and are brought up to the knives again, suffering further reduction and are ultimately thrown forward towards the mill. The device is fitted so that there is more or less clearance between the bottom of it and the bed of the feed race. In practice, a clearance of about one-half inch is most desirable. The most effective arrangement which has been tested out in practice utilizes two of these devices operating in series. The first one is set with a clearance of 10 to 24 in. above the floor of the carrier depending on the height at which cane is delivered on to it. The most effective clearance is that which permits this first device to produce that amount of cuttings which suffices to fill the voids in

the mass of cane which passes it. The second device, which is near the mill, is set with very low clearance—preferably less than one inch above the floor of the carrier. With this arrangement a nearly perfect division and levelling of the feed is obtained. Trials have proved that with this apparatus the cane is finely divided and that little extra horse power is consumed in crushing high fibred cane above that required in the milling of low fibred canes.

IMPROVEMENTS IN FILTER-CLOTH. **Cornelis H. Caals**, of The Hague, Holland. 1,788,657. January 28th, 1931. A filter-cloth adapted to be used between the frames of filter-presses consists of two central woven filtering portions and a circumambient strengthened woven marginal portion in the shape of a rectilinear figure 8, the central filtering portions being within the marginal portions and being separated by the intermediate transverse portion of said Figure 8.—TREATING BAGASSE. **Earnest C. H. Valet**, of Mexico City. 1,792,202. February 10th, 1931. A process for treating bagasse fibres comprises first treating the fibres in a clear saturated solution of lime, later adding thereto a solution containing a suitable sulphite then treating the fibres in a solution containing caustic potash and a suitable sulphite and subsequently washing the fibres in a soap solution.—FERTILIZER FROM DISTILLERY RESIDUES. **Zdenko Metzl.** 1,799,176. April 7th, 1931. In a process for the manufacture of a dry and non-hygroscopic fertilizer from alcohol distillery or sugar factory residue and superphosphate, the characteristic feature of effecting the manufacture in two separate stages at different temperatures, which comprises heating in the first stage the said residue to about 70°C. with a quantity of superphosphate whose weight is equal to the weight of the residue taken, and heating in the second stage the resulting product to about 130°C. for the complete expulsion of the water and the remaining organic acids set free during the first stage.—REACTIONS BETWEEN SUCROSE AND QUICKLIME. **Ralph W. Shafor**, of Denver, Colo. 1,800,667. April 14th, 1931. In apparatus for producing a reaction between lime and sucrose in the manufacture of sugar, a reaction tank partitioned into successively arranged compartments flowing one into another, means for feeding a reagent to the compartments, and an automatic weighing element for feeding the reagent to said means.—EXTRACTION AND PURIFICATION OF BEET JUICE. **Arnaldo Guadagnini**, of New York. 1,798,792. March 31st, 1931. A process is provided by which slices are extracted with water, and the characteristic aromatic volatile substances of bad taste and smell are expelled. It consists in confining a mixture of slices and water in a closed vessel or autoclave, applying heat to cook the contents under pressure at half an atmosphere, superheating the vapour in the upper part of the vessel by a steam coil, subjecting the mixture to a further cooking operation under pressure, and again superheating the vapour in the upper part of the vessel for blowing off the vapourized impurities. Extraction takes 1¼ hours, and a depurated liquid containing the sugar with inorganic alts is thus obtained.—CANE CRUSHING APPARATUS. **Francis Maxwell**, of Wallington, Surrey. 1,792,502. February 17th, 1931. Claim is made for a scraper plate for cane crushing apparatus having a pressure roll and a shredding roll, said plate having teeth along an edge thereof, said teeth being adapted to enter grooves in the pressure roll disposed at one side of said plate, and a plurality of ribs upon the side of said plate opposite the pressure roll, said ribs being adapted to co-act with the shredding roll to shred cane passed therebetween, said ribs being radially beyond the periphery of said shredding roll. INTERMEDIATE CANE CARRIER. **Hugh P. Bobbins**, of Chicago, Ill. 1,794,491. March 3rd, 1931. Relates to an intermediate cane carrier comprising a frame, a nose shaft and a tail shaft mounted in the frame at the ends thereof, a head shaft mounted in the frame above and behind the nose shaft, a conveyor comprising overlapping pans and side chains, sprockets at the ends of said shafts engaging said chains, power means for driving the nose shaft, a chain drive between the nose and head shafts, means for adjusting the nose shaft relative to the head and tail shafts, and independent means for adjusting the chain drive between the nose and head shafts.

United States Atlantic Ports.

(*Willett & Gray*).

(Total of 2,240 lbs.)	1931 Tons.		1930 Tons.
Total Receipts, Jan. 1st to June 20th	1,205,232	..	1,274,045
Deliveries „ „ „	1,210,579	..	1,517,225
Meltings by Refiners „ „	1,155,275	..	1,406,729
Exports of Refined „ „	21,000	..	19,300
Importers' Stocks, June 20th	153,545	..	194,091
Total Stocks, „	294,625	..	464,181
	1930		1929
Total Consumption for twelve months	5,599,377	..	5,810,980

Cuba.

RECEIPTS, EXPORTS AND STOCK AT JUNE 20TH.

(*Willett & Gray*).

	1931 Tons.		1930 Tons.
Production to date	3,120,000	..	4,671,260
Less Cuban Consumption to date	66,000	..	50,000
	3,054,000	..	4,621,260
Stock at Shipping Ports	944,553	..	1,650,910
Total Exports	509,645	..	1,161,692
Total Receipts at Shipping Ports	1,454,198	..	2,812,602
Stock on Plantations and in transit to Ports	1,599,802	..	1,808,658
Total Sugar in Cuba (partly estimated)	3,422,761	..	3,459,568

Sugar Crops of the World.

(*Willett & Gray's Estimates to June 4th,* 1931.)

	1930-31. Tons.		1929-30. Tons.		1928-29. Tons.
CANE.					
America	7,665,904	....	9,387,959	....	9,443,377
Asia	7,883,434	....	7,368,766	....	7,274,922
Australasia	622,477	....	626,239	....	633,066
Africa	801,316	....	732,635	....	748,468
Europe	14,000	....	13,562	....	11,610
Total Cane	16,987,131	....	18,129,161	....	18,111,443
BEET.					
Europe	10,281,986	....	8,219,148	....	8,469,491
U.S.A.	1,075,688	....	901,713	....	938,640
Canada..............	40,953	....	27,869	....	28,857
Total Beet	11,398,627	....	9,148,730	....	9,436,988
TOTAL CANE AND BEET....	28,385,758		27,277,891		27,548,431

Sugar Market Report.

Our last report was dated 8th June, 1931.

During the period under review the markets generally have shown an upward tendency, especially in America. The Chadbourne plan which is now working has produced no startling movement in the price, but it is generally expected that the gradual improvement in the statistical situation will ultimately lead the market to higher levels, but it is bound to be a slow process.

A further stimulus was given to the market by the launching and final agreement of the Hoover plan concerning the war debt holiday. The effect of this on sugar is only sentimental, but nevertheless sentiment plays a big part in the fixing of prices from day to day.

There is very little change to report in the London Terminal Market, the only feature being that the premiums on forward months have widened out. August moved from 6s. 4d. to 6s. 3d. to 6s. 6½d. December from 6s. 7d. to 6s. 6½d. to 6s. 10d. March from 6s. 9d. to 6s. 8d. to 7s. 0¾d. and May from 6s. 11d. to 6s. 10½d. to 7s. 2¾d. The latest prices are :—

AUGUST	DECEMBER	MARCH	MAY
6s. 6d.	6s. 10d.	7s. 1d.	7s. 2¾d.

The trading in refined sugar was very quiet, but at times a certain amount of buying has taken place by the trade. On June 25th the Refiners advanced their prices 3d., but on July 8th they reduced them 3d. again, leaving them unchanged on the month, the latest prices being Tates No. 1 Cubes, 24s. 3d., London Granulated 20s. 7½d.

Business in Raws to the Refiners has been fairly active and the price has risen from 6s. 3d. to 6s. 6d. whilst parcels have been done at 6s. 6¾d. About 60,000 to 80,000 tons of Cubans were sold last week at 6s. 6d. c.i.f.

The American market has improved and at one time the Refiners paid up to 1·48 c.i.f. for Cubans, although the latest price is 1·45 c.i.f. This rise is brought about by the fact that Porto Rico and Philippines are now practically out of the market and the American refiners are more dependent on Cuban sugar.

F. O. Licht makes no further change in his estimate for Europe and the crop appears to be making satisfactory progress, although there are complaints of insects and too much rain in some countries and drought in others.

21, Mincing Lane,
London, E.C.3.
10th July, 1931.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 392. AUGUST, 1931. VOL. XXXIII.

Notes and Comments.

The Outlook.

In this number we are able to give the original text of the Articles of the Brussels Sugar Convention of 1931 which was signed on May 9th. It was assumed that immediately after that date the text would be released for publication, but for the time being the Sugar Council elected to withhold it from the public. On June 14th the Cuban Official Gazette on its own responsibility reproduced the text in full in Spanish, and it was shortly afterwards also published in the English text in New York. In view of this dual release, the Sugar Council could no longer exercise its veto on general publication, so the Articles will be found reproduced on another page of this issue. While running to considerable length, doubtless due to desire to cover every possible contingency, we think our regular readers will be glad to have on record in our pages the articles of an agreement that promises to become historic; for apart from its immediate and ultimate bearing on the industry concerned, it is not unlikely that the example of sugar industrialists will be followed by those who control the destinies of other world staple crops and products of the soil, nearly all of which are suffering from over-production and/or under-consumption.

The sugar market during the past month has not developed any marked changes, though there has been a welcome hardening in New York, which has been assisted by an increased demand from consumption (no doubt to replenish over-depleted stocks) and a firmness on the part of Cuban sellers which if maintained must benefit them in the end. The only uncertainty for Cuba at the moment is whether the quota earmarked for the U.S.A. (2,577,000 tons) will be all absorbed this year or not The consumption in the States for the first six months of 1931, as compared with the same period of 1930, shows a decrease of 200,000 tons or practically 7 per cent. It is quite possible that the second half of 1931 will make amends, but the general economic depression in the States is having a persistent influence on demand of all kinds.

In Europe, the financial crisis which has nearly overwhelmed Germany and has been, very fortunately, staved off for the time being by International action, has had its repercussions on the market to the extent that there has

been a fear manifested lest Germany should be forced to jettison on the market her segregated sugar. But so far there has been no indication of resort being needed for so desperate a step, and taking things as a whole the crisis has had surprisingly little influence on the sugar market. It is to be hoped that the firmness displayed will continue till the crisis is fully surmounted.

LICHT announces no change in his estimates of the European crop; weather has not been ideal but in most countries the crops are reported to be satisfactory. No suggestion has so far been made of there being a sugar yield above the average in store, and it must be assumed that unless there is a miraculous improvement in the final three months of growth there is no chance of last year's bumper yield being repeated. In Java the weather has not been favourable and the estimates are downward. In several other countries, also, the turn of a hitherto favourable tide has been indicated. Altogether, production is showing a marked tendency to return to average or under-average results, all of which will help to check production and allow consumption to catch up.

Philippine Opinion on the Chadbourne Agreement.

We have mentioned more than once lately that the principal sugar exporting country which has so far kept clear of participation in the sugar restriction pact is the Philippines; what is more, they have shown such an eagerness to dispose of their 1930-31 crop on the New York market at buyers' prices that this has proved a bear point in retarding the recovery in price which the signing of the Brussels Agreement might otherwise have brought along. And a start has already been made at selling the next crop at current rates.[1]

In view of this, it is of some interest to ascertain the opinion held in the Philippines, as voiced in their *Sugar News*.[2] The Editor agrees that the Chadbourne Plan will do the industry no harm and may do it considerable good, provided self-interest is kept out of the picture, "We in the Philippines, who are struggling to keep our heads above water in the production of sugar, are grateful to Mr. CHADBOURNE and his confrères in their efforts to stabilize a rather unstable condition, and he can look to us for such co-operative efforts as may from time to time be required from those countries producing sugar for consumption in the American market." In view of this offer of co-operation, the rest of the signatories to the pact will trust that it is translated into action in the coming months and that the Philippines will see their way, if not actually to join the pact, at any rate to assist in spirit the endeavour to revive the depressed sugar market.

Another writer in the same issue of our contemporary is more sceptical as to results accruing from the restriction pact. He deems that the recent course of the market leaves little room for optimistic views as to improvement in the near future; the disposal of surplus stocks will take perhaps a longer time than most people imagine. "The general opinion in the United States appears highly sceptical . . . Meantime we advise our readers not to entertain any extravagant expectations."

It seems evident, then, that the bearish standpoint which has ruled New York for some months past, and is only now reluctantly veering round to a

1 According to HUMBERT, lately estimated at 225,000 tons; and this German statistician expresses the view that these early new crop sales clearly prove the correctness of the conclusion put forward by a leading company that the duty advantage of 2 cents in the U.S.A. for P.I. sugars is so excessive that the Philippines in particular can afford to sacrifice a large part of it.

2 June, 1931.

different angle of view, has spread to the Philippines and has dictated a course of precipitate action just when other large exporters were disposed to stand firm and see the pact through. That this pessimistic view is not widespread is proved by the success in getting the agreement signed. At the same time the signatories are well aware that no rapid improvement is indicated : indeed, they did not postulate it in drawing up their agreement. This was planned for five years in the belief that a steady if gradual improvement would be more beneficial to the market than any spectacular rises at short notice : it is not desired to encourage an increase in planting or sowing in the opening years of the five-year period. But while that is conceded, there is no belief held in the necessity for present-day prices to rule for another year or more. The general world industrial situation has its effect on markets, of course, and should there be no improvement in the pessimistic outlook within the next few months the staple markets will continue to reflect the depression. On the other hand if the financial problems of Europe are settled satisfactorily and a turn for the better in international trade makes itself apparent, sugar will be one of the first to respond. If sugar does not respond during 1931, the factors in its favour at the commencement of 1932 should, other things equal, be strong enough to have some effect on the market, for then the consequences of restriction will be making themselves apparent.

Before leaving the subject of the Philippines it may be noted that (to paraphrase the writer above mentioned) the preservation of the present free trade relations with the United States is simply a bread and butter policy so far as the Philippine sugar industry is concerned : indeed it is a matter of life or death as world conditions are at present, for any sudden rupture of those relations would spell disaster to Philippine sugar production. So long as certain political interests in the States continue to agitate for a tariff on Philippine imports, feeling in the islands as to their future must continue to be tinged with uncertainty. It may well be that the problem of securing a profitable market for their sugar has to be subordinated to the problem of retaining a market at all.

An Imperial Sugar Cane Research Conference.

The Empire Marketing Board, which was started to provide a means of assisting by any methods other than fiscal the development of trade and industry between the component parts of the British Empire has not neglected the research side and has financed investigations and encouraged co-operation in this important aspect of industry. The meeting this summer in London of a considerable number of heads of departments of Agriculture of Empire countries as well as of technologists interested in the agricultural side of production, suggested to the Marketing Board the advisability of holding a sugar cane research conference, at which as many of the visitors as were interested in sugar cane cultivation and research might take a part and exchange views and opinions. The Conference membership was necessarily incomplete so far as many of the leading sugar technologists of the Empire were concerned, but the short notice under which the Conference was convened precluded many well-known savants from attending. In spite of this, the Conference was not unsuccessful, and made a useful start, which we trust will be the precursor of other more representative gatherings of the sugar technologists of the Empire. On another page we give the resolutions passed by the Conference, as a complement to the papers read and the discussion they gave rise to.

Australian Affairs.

In view of the termination next month of the Commonwealth Sugar Agreement in Australia it will be remembered that last Autumn a Committee of some eight members was appointed by the Government to hold an inquiry into the whole sugar question. This Committee had no less than 14 questions to deal with under the terms of reference, covering every phase of the industry, including relations between employers and employed, efficiency in field and factory, the effect of sugar prices upon other industries using sugar. The results of the investigation were published last March and consisted of three Reports—a General Report signed by all the members, a Majority Report by five, and a Minority Report signed by the Chairman and two others. General agreement was reached as to the satisfactory conditions of the workers, on the alleged alien penetration which was found to be less serious than was commonly supposed, on the extent of the by-products of the industry which were shown to be as fully utilized as is at present economically possible, and as to their being no advantage to be derived from the manufacture and marketing of mill whites under present Australian conditions.

The Majority Report expressed the view that the embargo method is much better than any other system of protecting the sugar industry and should continue to be renewed, subject to proper safeguards for the various classes of consumer ; that there were no grounds for recommending an early reduction in the present Australian selling prices ; that the problem of over-production is bound up with Government policy in peopling the sparsely populated far North, and any intention to curtail production should receive long notice; and, finally, that the embargo on the importation of sugar be continued for a period of five years ; and the prices of sugar and the conditions of the sale thereof for three years, with the proviso that the special price payable by manufacturers using sugar be discontinued and, instead, the sugar industry is to provide a sum annually of £315,000 for assisting these manufacturers.

The Minority Report considered that definite steps should be taken to reduce the unprofitable surplus production, that the price of sugar be reduced to the consumer for the next two years by £2. 6s. 8d. per ton, while the rebate to manufacturers should be continued. But both Majority and Minority Reports seem agreed that in respect of efficiency and absence of profiteering there is nothing to criticise in the conduct of the sugar industry.

It is now announced that the Australian Government after considering these Reports have decided to renew the embargo for a period of five years ; to assist the fruit and canning industries on the basis of the plan recommended by the Majority Report ; the existing selling prices to continue for three years longer and then to be reviewed and their figures to be determined for the last two years of the period. Meanwhile every effort must be made by the producers to keep their production within its present limits. The Government also accepts the figure arrived at by the Majority Report of the cost of production at £22. 7s. 9d. per ton, but arrangement is made for increasing the basic figure up to £23 in the case of a reduced production, to allow for larger overhead costs.

It is gathered that one condition which is alleged to have weighed heavily with the Government in coming to this decision was the present urgent necessity to retain the (approximately) £2,000,000 credits in London which are derived from the export of sugar ; there was also the fear of increasing unemployment in the sugar growing districts. Whatever the motive, the Government verdict on this protracted investigation will be received by the Australian sugar industry with feelings of relief.

American and German Technique.

Russia's recent resort to foreign assistance in order to improve its industrial and economic status has been chiefly to Germany and the United States. The engineering methods of these two countries offer a contrast which has lately formed the subject of an article in a Russian journal. Our American contemporary, *Mechanical Engineering*, gives the gist of this article in a recent number, from which we take the following points.

The American seeks the greatest simplicity in the solution of technical problems. Frequently he finds an accidental and simple solution, but does not establish the fundamental reason. The tremendous scale of economic life in the U.S.A. compels the American engineer to resort to bold constructions, the efficiency and versatility of which are surprising. One especially characteristic American procedure is that of combining many operations in one machine to accomplish one complete technical process, peculiar value being placed on light construction of each part. Thus, in machinery designed for fluctuating loads and compacts the American does not hesitate to increase the cross-sections 25 to 30 per cent. over that which his strength and stiffness calculations indicate. He starts with the premise that it is more important to reduce the cost of production of the product of the machine than to reduce the cost of the machine itself.

The foregoing relates only to the construction of single products. For mass production the American freely employs special steels and alloys to attain continuity of operation, while endeavouring to reduce costs of production through industrial management. Notwithstanding, this technique has its drawbacks. The dependence of the American designer on practical experience leads him to neglect scientific investigation in the solution of questions of construction. He is more an inventor than a researcher. Thus he shines in all spheres which embrace chiefly the purely practical viewpoints and experiences (machines for road-building, agricultural operations, metal working, materials handling) but is significantly weak in those depending on the fundamental toilsome results of theoretical research, such as constructions for chemical industries and for high pressures.

As a contrast, the technical science of Europe, and in particular Germany, serves to a greater extent the realm of scientific investigation which sometimes opens wide horizons and radically changes existing technical views. It is only necessary to point to Germany's success in the realm of applied chemistry, high-pressures development, high speed and stainless steels, etc. The improvement and simplification of existing forms rather than a research for new forms and new ideas in machine construction distinguishes German technical science from the American. And since German constructors build to a large extent for foreign markets, they cannot afford to use more material in a machine than what their computations indicate. This, together with the more economical use of expensive metals and alloys, cheaper labour and materials, and finally especially careful and economical plant management, places the German machine industry in a position where it is possible to deliver machines in no wise inferior to American products but which are up to 40 per cent. cheaper in price.

This Russian observer concludes by remarking that with the present common front of world technique, universal technical journalism, and the fact that there are no longer any manufacturing secrets, there can be no such material superiority in one construction over another as to justify a 40 to 50 per cent. higher price.

Industrial Research as applied to Cane and Sugar.

By EARL L. SYMES.

The cane sugar industry has probably shown less progress through industrial research than any other great world industry whose activities are scattered in many different countries all around the globe. Large sums have been expended on agricultural research, resulting in larger yields of cane and sugar per acre and contributing to the surplus stocks of sugar that have troubled the planters for the past few years. If one quarter of the expenditure had been made on industrial research with similar successful results in finding new products from the cane and sugar and improving the old standbys, the course of events during the last five years might have been quite different. Producers of sugar might not have had to take less than their costs for fourteen consecutive months, when forced to sell their output.

Isolated efforts to obtain new products from cane fibre and sugar have been successful during the past few years and indicate what might have been achieved ten or more years ago if organized industrial research had been inaugurated when the large corporations with million dollar capital were developed to consolidate sugar properties. Industrial research is a type of insurance and the failure to include appropriations for its conduct in the annual budgets has caused tremendous losses. By depending on sugar alone for profits, fifteen American companies producing sugar in Cuba have lost more than thirty million dollars during the past five years. They have paid for industrial research without obtaining its benefits, and the charge appears in the annual financial statements marked *deficit.*

Sugar is the world's supreme quick energy food. Athletes use it to repair rapidly their tiring muscles. They win races with it.

Considering the usual stimulating effects of sugar as a food, one is at a loss to explain its seeming narcotic power over the producers and financial leaders in the sugar industry. That they have only partially awakened from the lethargic somnolence into which they had fallen is indicated by the adoption of quack remedies for their troubles. Their long period of inaction must be replaced by hard work and serious thinking ; new products from the cane and sugar, and new markets for sugar and its by-products must be developed. The surrender of established markets by the cane sugar producers to the beet sugar exporters is not going to solve their problems.

Intensive research has led to the great progress recorded in the automobile, aviation, petroleum, telephone, radio and cellulose industries during the past few years. Their products enter international trade and meet keen competition in many areas, yet their sales are continuously increasing the markets expanding into new territories. The leaders of these industries know that certain sums must be spent on marketing and industrial research in order to maintain their sales position and increase its volume.

Research has recently developed many useful products from cellulose, which is one of the components of sugar cane forming part of the fibre which is regularly burned in the factory furnaces. Forest trees and cotton have provided the cellulose used in the production of paper, rayon, cellophane and cellulose nitrate and acetates which form the raw materials for photographic film and paint lacquers. Mr. DE LA ROSA in Cuba has demonstrated that high grade alpha cellulose can be obtained from cane fibre, and various manufacturers in the United States have made rayon, smokeless powder and cellulose lacquers from this Cuban raw material. The Vazcane and Celotex methods of producing insulating lumber from cane fibre are well known.

Mention of these three developments practically summarizes what has been done on cane fibre during the past ten years. Financial difficulties have

undoubtedly hindered their wider application during the last five years. Limited markets are also a factor in the building board trade with growing competition from new and high grade types of artificial lumber. The successful utilization of cane fibre requires a ready market and a simple process applicable to present day milling establishments without expensive or elaborate equipment. The product most likely to meet these requirements is paper pulp. The cooking and beating operations necessary to convert bagasse into an easily marketable paper pulp are simple and could be carried on regularly in the cane sugar factory with ordinary help and supervision. Some individual work has been done on this problem. An opportunity to develop a successful pulping process for bagasse is offered by the recently established Institute of Paper Chemistry at Lawrence University in Appleton, Wisconsin. Many large wood pulping plants surround this location and the directors are willing to co-operate with leaders in the sugar industry in founding a Fellowship for the study of cane fibre problems.

A definite chemical formula for sucrose has been known to chemists for years and ordinary reactions, such as the formation of the various calcium saccharates used in the Steffens process of sucrose recovery from beet molasses, have been put to practical use. In spite of this common knowledge much less progress has been made in the diversification of products from sucrose than from cellulose, whose chemical formula is not so definitely fixed among the chemists. The recent rapid rise of cellophane from cellulose is an example. This pliant transparent wrapping is now found in commercial use to cover a variety of articles from headache pills to full sized bed mattresses. Recently announced results of research on sucrose indicate that a great variety of new products may soon be available from this source.

On June 9th, 1931, the *New York Herald Tribune* carried an account of the nine-year research carried on by Mr. ARTHUR S. FORD, a chemical engineer, with the object of obtaining some industrial products in the non-food field from sucrose. In this new process solid and plastic substances may be made by polymerizing sucrose. Variations in the treatment of the sucrose containing material, which may be refined sugar or molasses, produce different end products. Treated in one way it freezes into a hard glassy substance which may be used as a glass substitute with the advantage that it may be cut into any shape with a sharp knife ; lenses and other useful articles may be made from this non-shatterable glass-like material. Another variation in the procedure will produce a water-white transparent rubber-like substance suitable for artificial leather work and other similar uses. It is also possible to produce a cellulose-like solid to replace the inflammable celluloid which is said to be whiter and more brilliant and of course non-inflammable. It is also stated that when powdered and pressed in a hot mould this sucrose polymer may take the place of electrical insulators and with appropriate colouring resemble a jade box, an amethyst vase, an amber comb or a pearl button.

Experiments indicate that this new substance may be mixed with cellulose nitrate to reduce the cost of this material, and also minimize its fire hazard. Som· of the uses contemplated for this material from sucrose are artificial leather, wall hangings, adhesives, textiles, lenses, photographic films, transparent wrapping sheets, roofing tiles, paints, varnishes. One of the enthusiastic boosters of this new material stated that the woman of the immediate future might look forward to being clothed from head to foot in spun sugar polymerized by the Ford process, wearing shoes made of sugar leather with heels of sugar plastic ; write with a sugar pen from a sugar mounted bag,

which contains an unbreakable sugar mirror, sit in a sugar plastic chair and watch a picture projected by a sugar lens through a sugar photographic film. It might be added that a little package of sugar candy would help to round off the picture.

It is understood that this new plastic material can be produced for about 9½ cents (4⅝d.) per lb., which is well under the current prices for standard plastics. It is possible that by carrying on the manufacture of this product in producing countries the costs may be lowered. If the claims for this new process and its products are not overdrawn, it may offer an outlet for a large quantity of the surplus sugar that is now troubling the sugar producers. The licences to manufacture synthetic resins and plastics under the Ford process are now available, and several large chemical companies have become interested in the new products.

Individual efforts to carry on industrial research are usually beset with numerous difficulties which in many cases are overcome when the problems are taken up by a strongly organized research institute. The creation of such an organization should have been one of the chief objects of the great sugar corporations controlling from five to fifteen sugar factories such as those operating in Cuba. Considering the bankruptcies of the larger of these companies, it is difficult to believe that there is any advantage in a company owning more than one mill. Certainly the only progressive activities, such as industrial research and market development, which might be more easily carried on by the united support of many factories, have been grossly neglected. It is to be hoped that the recent hard economic jolts that the sugar producers have received may awaken them to the necessity for such research.

Formosan Sugar Production in 1930-31.

The British Consul at Tamsui has informed the Department of Overseas Trade that a report just issued by the Government-General states that production of sugar during the 1930-31 season amounted to 13,118,054 piculs (774,621 tons) of centrifugals—including plantation white—and 164,449 piculs of brown sugar (9,711 tons), making a total of 13,282,503 piculs (784,332 tons). There is thus a decrease of 225,549 piculs (13,319 tons) as compared with the previous year.

The average sugar content was 13·55 per cent., an increase of 0·83 per cent. as compared with 1929-30.

Results obtained by the various companies were as follows :—

Name of Company.	Production. Piculs.	Sugar Content. Per Cent.
Taiwan Sugar Company	3,547,830	14·55
Shinko	173,354	13·10
Meiji	2,477,232	13·42
Dai Nippon	2,538,459	13·63
Ensuiko	1,810,683	13·33
Niitaka	712,445	13·18
Teikoku	1,330,128	12·55
Showa	290,900	12·78
Taito	102,979	13·49
Shinchiku	81,241	12·64
Saroku	52,803	11·00
Total	13,118,054	Average. 13·59

Imperial Sugar Cane Research Conference, 1931.

A London Gathering.

As far back as last Autumn proposals were made to the Research Grants Committee of the Empire Marketing Board that they should consider the question of convening a conference of sugar research specialists of the Empire. The idea was considered favourably, and it was thought that the best time for such a conference would be in July of this year, at which date a conference of Colonial Directors of Agriculture was due to meet in London.

Invitations to take part in the Conference were accordingly sent to Government bodies and research stations throughout the Empire, as well as to important individuals associated with sugar cane technology. A committee was formed to draft the agenda, and this was drawn up with the idea of including an economic survey of the world sugar position as well as one of sugar cane research in its various aspects. Eventually it was found impracticable at such short notice to adopt the larger programme first envisaged but the Conference as actually held included papers on World sugar economics by Mr. B. A. Forster, Dr. C. A. Barber, and several others, Sugar Cane Research in the Empire, Sugar Cane Entomology and Mycology, and By-products of the Sugar Industry. The papers on Research included such subjects as Cane Breeding, Soil Studies, Cane Farming, Cane Diseases.

Although the short notice given precluded a number of leading Empire technologists from attending, there was nevertheless a good gathering and about 40 delegates from the United Kingdom and from all over the Empire were present. Amongst the more prominent may be mentioned Mr. G. Evans C.I.E. and Prof. F. Hardy, of the Imperial College of Tropical Agriculture, Prof. F. S. Dash of British Guiana, Mr. F. A. Stockdale, C.B.E., of Mauritius, Prof. H. A. Ballou of Trinidad, Mr. S. J. Saint of Barbados, Mr. M. W. Sayer, of India. Home institutions were represented by Mr. H. C. Sampson, C.I.E., of Kew Gardens, Mr. W. G. Freeman of the Imperial Institute, Dr. W. R. Thompson of the Imperial Institute of Entomology, Mr. S. F. Ashby of the Imperial Mycological Institute; while individual members included Lord Olivier, Sir Algernon Aspinall, C.M.G., Mr. B. A. Forster (of Messrs. C. Czarnikow), Sir Louis Souchon, K.B.E., and Dr. H. Tempany.[1] The Empire Marketing Board was represented amongst others by Mr. L. S. Amery, M.P., and Sir Edward Davson, Bart.

After the reading of various papers (which will eventually be printed in the Report of the Proceedings) a number of recommendations were discussed and passed. The following is the list of these Resolutions.

Resolutions.

(1) The Imperial Sugar Cane Research Conference desires to place on record its conviction of the necessity for developing research on the economic as well as the scientific aspects of sugar cane production throughout the Empire and considers that there is scope for measures of closer co-operation in both fields. In accordance with the recommendations of the Research Committee of the Imperial Conference of 1930, it urges that steps should be taken to facilitate such co-operation by providing for the interchange of information and by the promotion of inter-territorial visits by specialists.

(2) The Conference has examined with interest the papers which have been laid before it on the subjects of the general economic position and the marketing of sugar and commends these to the notice of the Imperial Economic Committee with a view to the preparation of further similar surveys for the information of sugar-producing countries in the Empire.

[1] Dr. C. A. Barber, C.I.E., was unfortunately precluded by illness from attending and reading his paper.

(3) The Conference has taken note of wide differences in the economic conditions in which sugar cane is grown and supplied to control factories in different parts of the Empire. It observes that, in some areas, the small farm system is prevalent and in others the system of large estates. The Conference recommends that, in all parts of the overseas Empire where this is desirable and feasible, investigations should be made into the relative efficiency of large and small units of cultivation.

(4) The Conference is impressed by the variety of the labour conditions prevailing in the principal sugar growing countries of the Empire and, having regard to the vital importance of this factor, considers it essential that each Government concerned should enquire into the conditions affecting the efficiency of labour in the sugar cane industry in its territory.

(5) The Conference desires to stress the fact that, while in the British Empire there have been very marked advances in recent years in factory efficiency and technological methods, these have not been paralleled by similar advances in the field and, having regard to the fact that a principal item in the cost of production of sugar is the expense of cultivation, urges the necessity of including in research programmes adequate provision for work on the improvement of agricultural methods.

(6) The Conference considers that it will make both for efficiency and for economy if systematic work on cane breeding is concentrated in a limited number of stations. It has reason to believe that four central breeding stations located in India, Australia, Mauritius and the West Indies should serve the needs of the sugar cane industry of the Empire and that the scope and usefulness of such stations could be greatly increased by the interchange of information, the issue of seed (fuzz) and young seedlings, and the exchange of planting material. It should, however, be stressed that the work of these stations will require to be supplemented by trials of selected varieties laid out on approved lines in each cane-growing country.

(7) The Conference recommends that the programme of the proposed central cane-breeding stations should include morphological work of the kind involved in a study of root systems, in correlation with physiological studies. While genetic work of a fundamental character is unlikely to produce results of economic value within any reasonable time, the Conference suggests that central cane-breeding stations should obtain additional material for their work by the collection of the older canes and especially of those still growing in a wild or semi-wild state.

(8) The Conference has taken note of the Report presented by the Committee appointed to consider the requirements of the sugar industry in the West Indian area in respect of research and investigation. It endorses the recommendations made by the Committee and commends them to the favourable consideration of the Governments concerned.

(9) The Conference desires to place on record its appreciation of the services rendered to sugar cane cultivation in the Empire by the Imperial Institute of Entomology. It seems likely that, for the control of insect pests of the sugar cane, increasing reliance may have to be placed on biological methods. In this connexion the Conference would urge the desirability of providing for the continuation of the work now proceeding on this problem in the West Indies, and for the extension of work of this type to other countries in the Empire as occasion may demand. It seems desirable that consideration should be given to the possibility of retaining the services of entomologists with practical experience of this type of work with a view to avoiding the dispersal of specialist staffs whenever the immediate work on which they have been engaged is completed.

(10) The Conference has heard with interest the review of the present position in relation to fungoid diseases of sugar cane presented by Mr. ASHBY. It desires to place on record its sense of the importance of the work now being carried on by the Imperial Mycological Institute. It appreciates that there are a number of major diseases of sugar cane which might, if introduced into countries where they do not at present exist, do very serious damage to the industry. Many of these diseases may remain latent in sugar cane for considerable periods, amounting occasionally to more than one year. The Conference is therefore of opinion that the provision of adequate arrangements for quarantine is essential whenever canes are introduced into one

region from another and strongly urges that steps should be taken to establish central quarantine stations in appropriate areas.

(11) The Conference has taken note of the information contained in the paper submitted by Mr. W. G. Freeman relative to by-products of the cane sugar industry. It is of opinion that, in the British Empire, more attention could profitably be paid to the question of the utilization of such by-products. It recommends that a survey of the subject should be undertaken.

(12) The Conference desires to place on record its appreciation of the initiative taken by the Empire Marketing Board in convening this, the first Imperial Sugar Cane Research Conference. It is of opinion that only through such meetings can a comprehensive survey be secured of the position of the sugar cane industry in the British Empire as a whole, having regard to the varying conditions which obtain in its different parts. The Conference is further of opinion that, notwithstanding the geographical separation of these units and the variety of their climatic and other conditions, it is essential that their interdependence should be recognized. The greatest measure of success in dealing with the various research problems of the industry will be achieved only if provision is made, from time to time, for the joint consideration of these problems by representatives from the different sugar cane producing countries of the Empire.

The Uba Cane.

Some Further Evidence as to its Origin.

By Sir ARTHUR W. HILL, K.C.M.G., Director of the Royal Botanic Gardens, Kew.

A good deal has been written on one occasion or another upon the history of the Uba cane of Natal and the origin of the name. From a perusal of these accounts there appears to be little doubt but that the cane is of Indian origin and that the name originated through joining up the only three letters that were legible on a package of canes received at Durban from India. There has, however, been a doubt as to the person who imported the canes and the exact year. Some particulars of the supposed introduction were given in "Cedara Memoirs on South African Agriculture" by E. R. Sawer, Director, Division of Agriculture, Natal, p. 67 (1912). The author says, "Of the earlier introductions none continues to hold any important place in modern planting; and they have almost everywhere been supplanted by a variety the correct name of which is unknown, but which is here called Uba—a name, it is said, formed of the only letters remaining legible on a damaged label attached to the variety on its first arrival in the country. Mr. Medley Wood thinks it was introduced by Governor Charles Mitchell who, on returning from a visit to India in 1884-5, brought two Wardian cases containing cane plants, only three of which were alive. These were propagated by Mr. Wood, the resulting plants being given to Mr. Anthony Wilkinson. It is generally admitted, however, that this cane was introduced in quantity by Mr. du Casse (de Pass) of the Reunion Estate."

Dr. C. A. Barber in his research on sugar canes took up the question of Uba cane and in a note on the origin of that cane which appeared in 1918 in the *I.S.J.*, 1918, p. 19, he says "There is no doubt whatever that it is a Ganna cane of the Pansahi group of Indian canes, a series which is grown in many places, from Assam to the Punjab, but it is perhaps best suited to Bihar where there are a number of canes of this group." Dr. Barber tried to locate the name Uba or Yuba but failed to come across any Indian language with *Uba* in it. In Burma he found that "u-ba" meant "take it" and he

suggested that Governor MITCHELL might have seen the canes in a Burmese port, asked for a few and been answered " u-ba."

In an obituary notice on JOHN MEDLEY WOOD which appeared in *Kew Bulletin*, 1915, pp. 417-419, reference is made to his dealing with a parcel of unknown canes in the early days of his connexion with the Botanical Gardens, Durban, and those canes have been thought to be the ones from which the well-known Uba cane arose. In view of recent information, however, it appears to be fairly certain that the canes dealt with by Mr. WOOD are not the canes that gave rise to the name " Uba."

During the recent visit of the writer to South Africa, he obtained information that leaves no doubt as to the cane having been received from India and at the same time clears up the mystery of its introduction to Natal and the origin of its name. He was by chance a fellow-traveller on board ship with Mr. ALFRED A. DE PASS, the late owner of the Reunion Estate in Natal, and learnt from him that the cultivation of " Uba " cane was begun on this estate in Natal which was called "Reunion" because it was the result of a fusion of several small estates. Mr. DE PASS handed a written statement of the history of the introduction of the cane to the writer, which is as follows :—

" This (Uba cane) was introduced to Natal from Calcutta by the undersigned representing his father DANIEL DE PASS of Reunion Sugar Estate, Isipingo, Natal, in the year 1883 from Messrs. MACKINNON and MACKENZIE & Co., Calcutta, who presumably procured this and twenty other varieties they sent out from the Botanical Gardens there. RICHARD (DICK) KING'S land formed part of the Reunion Estate and it is a coincidence that the land which was granted to him in gratitude for saving the country in the thirties should fifty years later have been the means of saving the sugar industry in Natal.

" The name was coined at Reunion by the overseer GEORGE WADE (who looked after the young plants) and the manager, ALFRED COOLEY, as the labels were damaged and these three letters were all they could read.

" Press copy of my letter ordering or rather asking MACKINNON and MACKENZIE to send the cane in 1883 I gave to Sir CHARLES SMITH of Durban. DANIEL DE PASS traded as Spence & Co., and cane was asked for in their name from MACKINNON and MACKENZIE."

Following this information attempts were made to procure a copy of the list of varieties sent from Calcutta at that date but such a list could not be traced by Messrs. MACKINNON and MACKENZIE nor by the Calcutta Botanic Gardens, the records for the period having been destroyed. The assumption is that the letters U.B.A. were not part of the name of the variety but of Durban, the port to which the plants were consigned.

It may have been taken from the general label placed on the consignment by the clerk who handed over the canes for packing. It would be natural for a slip of paper with the name of the place to which the parcel was to be sent to have been placed on the package when sending it to the packing shed. In this case it was *Durban*. Since the label, the only clue as to names, was partly obliterated in transit and the three letters U.B.A. were all that was legible, it seems a possible explanation that the name " Uba " is derived from those three letters in the name of Durban, the place to which the parcel was sent.

This, however, does not dispose of the claim that a sugar cane which has long been grown in Brazil under the name of Ubá is the same as the Natal Uba.

NOEL DEERR contributes a short note on " The Origin of the Uba Cane " to the *I.S.J.*, 1918, p. 164, which reads as follows :—

" Access to the excellent libraries in New York has enabled me to locate references which throw light on the origin of the Uba cane.

"The Report of the Royal Botanic Gardens of Mauritius for 1870 gives an account of a large number of varieties of canes that were imported to that island in 1869. Amongst these importations were six varieties from Brazil, and included therein is the Uba cane. It is classed in the report as 'a worthless variety.'

"In *The Sugar Cane* for June, July and August, 1877, there appears a translation from the Portuguese of the report of a committee that was appointed to investigate the alleged successful grafting of the sugar cane. Frequent reference is made in this report to the Uba cane as a variety well established at that date. It can also be inferred from the report that the existence of the Uba cane in Brazil runs back for many years.

"I was fortunate enough to find a copy of the very rare *De arboribus fructibus et herbis medicis atque alimentarii nascentibus in Brasilia et regionibus vicinis* of Piso, dated 1658. The description of the sugar cane begins with the words 'Haec arundo, *Viba et Tacomaree*, Lusitanis Canna d'Açuquare, dictâ . . . . .' The words italicized are the native Brazilian equivalents for a reed or cane.

"The same copy of Piso contained the *Tractatus topographicus et meteorologicus Brasiliae* of Marcgraf. In the section De armis Brasiliensium the following passage occurs: 'Sagittas ex arundine silvestri faciunt et vocant utramque rem uno nomine *Vuba*.'

"From these passages it is possible to deduce that the Uba cane found its way to Natal from Brazil viâ Mauritius subsequent to 1869, and that it travelled under and was known by the name of Uba. The derivation may without much doubt be ascribed to the native Brazilian *Viba* or *Vuba*, meaning a reed.

"Dr. BARBER has identified the Uba cane as one of the Ganna canes of India, and this identification suggests a speculation based on the argument given below, which I cannot refrain from hazarding. The sugar cane reached Europe in the ninth century, A.D., and had presumably travelled there from India, with Arabic and Moslem civilization. In 1420 the Portuguese took it to Madeira and in 1506 to Brazil, the Spanish taking it to San Domingo and to the Antilles. The cane thus introduced can hardly be any other than that variety which Piso saw and described in the seventeenth century. I would therefore suggest that the native term of Viba or Vuba became attached to the only variety cultivated on the later introduction of other varieties. If this supposition is correct, then the Uba cane is none other than that which received the name of 'Creole' or 'Canne du pays' in the West Indies, when it became necessary to find a distinctive name for the variety cultivated before the introduction of the Batavian and Otaheite canes in the closing years of the eighteenth century."

On referring to the Report of the Mauritius Botanical Gardens for 1869, the following reference is made to canes imported from Brazil:—"Of these canes the following have been grown, viz. Canne Imperiale, 8; C. Verte, 6; C. Ribbon, 2; C. Uba, 6 (a worthless variety); C. St. Julien, 4. Four of these are apparently fine canes, and have been cut for propagation." One can conclude from this that the "worthless variety" (Uba) was not further propagated. In a report on seedling canes of the Oriental Estates Co., Ltd., of Mauritius, which was received at Kew in August 1897, a list of several varieties then being grown at Marton, Vacoas, is given and mention is made of Uba, a thin green cane which gave, on analysis, Sucrose per cent. 17·34, Purity 88·46, and percentage of sugar in cane 14·55. This is referred to by Mr. FRED NASH the Manager, as "Staple cane of Natal, whence I brought it. Thin prolific

cane, 50 and upwards to hole." It is evident from this that the Uba cane was not generally known in Mauritius previous to its introduction from Natal.

A further account of the Brazilian Uba cane is published in the *I.S.J.*, 1920, pp. 326-28. Here a letter from Mr. ALFRED J. WATTS of Pernambuco, Brazil, is published. He first went to Pernambuco in the year 1884 and found various canes originally brought from Mauritius in cultivation.

He adds "The 'Ubá' (we put the accent on the final vowel here; I cannot say on what authority) is here, however, a totally different kind of cane. It was then, and still is, grown on the estate of the late Dr. PAULO SALGADE, for many years President of the 'Sociodade Auxiliadora d'Agricultura de Pernambuco' and there only, and only as a hedge to screen more succulent varieties from the depredations of passers-by. Its reception by the management of the neighbouring Central was always a bone of contention between the planter and the factory managers, who objected to the sacrifice to their yields by grinding 'walking sticks,' the average diameter not reaching an inch and being very hard at that. The juice was pure, what little there was of it . . . . I have two letters from Dr. SALGADE in which he says: 'In 1880 an African who worked in my orchard, having gone into the neighbourhood of the town of Cabo (30 kilometres from the capital town, Recife), brought home very contentedly two canes, "Uba" canes, saying that they were canes of his native land, Angola. I planted them carefully and developed them and wrote a paper about them, comparing their results in my factory, a small factory with a copper wall, Wetzel pans and centrifugals, with those from "cayanna" (Bourbon) cane, in that year very sick with the gumming disease. This was published in the first issue of the Agricultural Society Bulletin, in 1882. In 1901, when in Rio, I learnt in conversation with members of the Soc. Nacional d'Agricultura that it still grew in Rio, where it is used as a forage plant, and last year, 1917, I was shown Uba cane among the forage plants exactly similar to our own.'

"In a second letter he wrote to me, he further stated that: 'After my African gardener planted the canes I acquired the "Estudes Agricolas" of Dr. JOÀO JOSÉ CARNEIRO DA SILVA (Barac de Monte Cedro), agriculturist in En Campes, State of Rio, and co-proprietor of the Central Factory "Quissa man." In the first volume, of 1872, p. 8, I read: There grows among us a variety of cane, which perhaps improved by careful cultivation may become the selected cane of these regions. I refer to the Uba, which, according to some, is indigenous in this place. We cannot affirm nor contest this belief with respect to the Uba cane.'"

The suggestion hazarded by NOEL DEERR in his notes that the Ubá cane of Brazil is the original cane taken to Brazil by the Portuguese early in the sixteenth century seems to bear confirmation from Mr. WATTS' letter; for it is quite probable that the Portuguese, after introducing this cane to Madeira, would spread it to the mainland in Angola, where it would become the local cane.

So far none of the evidence given proves that the Ubá cane of Brazil and the Uba cane of Natal are the same variety, and until this is done it may be concluded that it is a mere coincidence that two northern Indian reed canes should, when introduced into two different parts of the world, get similar names given to them; in the case of Brazil the name Ubá is taken from the aboriginal name for a reed (in MICHAELIS' New Dictionary of the Portuguese and English Language, 1893, the word Uba is referred to as "(Bras) a sort of cane or reed.") In the case of the Natal Uba it has been taken from the remains of a label which in all probability formed part of the word "Durban."

South African Sugar Notes.

(From a Correspondent).

The Price Position.—Low prices continue to affect our sugar industry in common with the rest of the world. In spite of the present protection of £12. 10s. a ton it has not been possible to maintain the local maximum retail price of 3½d. per lb. This after various fluctuations now varies between 3d. and 3¼d. Practically no outside sugar is coming in except for a small amount of cubes which are not protected, in spite of the fact that a very good quality of domino sugar is now being manufactured locally. The average price of first refined sugar (after deduction of £1 excise) which was in the neighbourhood of £20 at the beginning of the year fell to £17. 11s. 1d. in May and was about the same in June.

The 1930 crop amounted to 393,000 tons, of which 50 per cent. was exported, 46 per cent. sold locally and 4 per cent. carried over. The sugar exported realised an average of £7. 12s. 6d. a ton on the London market. The deduction from the price of refined to meet rebates to manufacturers and shipments to coast ports was £2. 10s. per ton, which has been increased to £3. per ton for the coming season.

The Present Crop.—The latest estimate for the 1931-32 crop is 361,000 tons, but there is a considerable doubt whether this tonnage will be realized. We have passed through one of the severest Autumn droughts for many years, though at the moment of writing this appears to have broken, but a good deal of damage both to the mature and growing crops has already been sustained. In addition, during the last few days, there have been severe frosts in several localities which have caused extensive damage. The cane in nearly all districts is very light and a large proportion has had to be cut away or left in the fields in order to keep the consignments above the rejection point. The only exception to this state of affairs is in the extreme South of the sugar belt where more plentiful rains have given a heavy crop of cane, but so far retarded maturity that sucrose and purity are both exceptionally low.

If the full crop of 361,000 tons is realized, it is expected that 54 per cent. will have to be exported, this including the 4 per cent. carry-over from the preceding season. At the present price of refined sugar locally, and if the Chadbourne plan does not produce any more marked effect on the world market than is at present apparent, it is to be expected that cane of 13 per cent sucrose will not fetch above 11s. 5d. per ton, which is certainly an uneconomical rate.

Board of Trade Report.—The Board of Trade Commission which last year carried out an investigation of working of the Fahey Conference Agreement has now presented its report or rather reports. The majority report, signed by Messrs. F. J. FAHEY and G. S. H. ROSSOUW, recommends that the Government should by legislation establish a permanent Sugar Industry Arbitration Board, one member each to be appointed by the Natal Millers' Association and the South African Cane Growers' Association with a Chairman appointed by the Government. The Board to have power to adjudicate on :—

1. All disputes between Millers and Planters re the interpretation of the Fahey Conference Agreement.
2. All disputes re levies and payments for technical services, etc., and claims for interest on moneys due to Planters which are temporarily retained by Millers.
3. Revision of agreement on its expiry in 1937.
4. Any other matter affecting the industry which both representative bodies agree should be submitted to arbitration.

The Board further recommends that all mills should be liable to the terms of agreement entered into between the Millers and the Government in respect to export and manufacturers' rebates, and that each Miller should export a pro rata proportion of a total of 175,000 tons and that all sugar produced above home requirements and the above 175,000 tons should be exported by the Miller so producing.

Finally the Board recommends that for the duration of the agreement an export tax of £2 per ton should be levied on all sugar exported in any one year in excess of 175,000 tons.

The minority report signed by Mr. A. J. BRUWER, the Chairman of the Board, differs from the majority report in that it considers that no arbitration board is necessary, but recommends an unspecified export duty on all sugar exported in excess of an unspecified maximum.

Further, in its preliminary comments, the majority report expresses the opinion that Planters are entitled to payment of interest on all moneys retained by Millers, though it makes no definite recommendation that this should be done. It is an interesting fact that since the publication of the report the principal Milling Company has announced its intention to pay interest on retention money in future.

The necessity for a permanent arbitration board was one which was strongly urged by the Planters at the time of the enquiry, but was opposed by the Millers. The Planters had also pressed for some form of limitation of production, but neither side views with much favour the idea of an export tax, and it is generally felt that some better method of checking excess production could be devised.

No action was taken by the Government on the report prior to the adjournment of Parliament, so that no legislation can now be effected before next February. It is generally felt that the proposed export tax is not to meet with much support in any quarter.

General.—In order to eradicate all traces of Mosaic disease the growing of any type of cane other than Uba except under quarantine conditions was prohibited in 1927. Since then the Experiment Station has been actively investigating other types of cane suitable for our conditions. Early this year the first batch of new varieties was released for planting. These consisted of POJ 2725, POJ 2878 and CH 64/21. Small consignments were distributed to some hundreds of planters who mostly report very promising growth. The POJ canes are full of promise for the moister flat lands, and CH 64/21, though closely resembling Uba, appears to give a somewhat better tonnage and should prove a useful substitute in the hilly districts. It is hoped that consignments of POJ 2714, POJ 2727 and Co 290 will be released this year.

The South African Sugar Technologists' Association held their fifth Annual Congress in Durban last March under the Chairmanship of Mr. G. S. MOBERLY. The congress which was opened by the Mayor of Durban was highly successful, a large number of interesting papers being read, abstracts of most of which have already appeared in this Journal. South Africa missed a priceless opportunity in not being represented at the International Society of Cane Sugar Technologists' Conference in Soerabaya in 1929, but it is hoped that the mistake will be rectified next year, and arrangements are on foot for a strong delegation to represent the industry at San Juan, Porto Rico, next March.

10th July, 1931.


BLAIRS LIMITED
Sugar Machinery
BLAIRS LIMITED
GLASGOW ENGINEERING WORKS
ESTABLISHED 1838
INCORPORATING
Blair Campbell & McLean Ltd
A & P W McOnie
GLASGOW, S.W.1
Harvey Engineering Co
FORMERLY McOnie, Harvey & Co Ltd

Refining Qualities of Raw Sugars made in Hawaii.

In the last Report of the Raw Sugar Technical Committee of the Hawaiian Sugar Planters' Association, an account is given of investigations which are constantly being carried on for the improvement of the raw sugars which are destined for the Crockett refinery. Data are returned each year for the size of grain and the dark seed grain, as well as for the following figures : polarization, filtration rate, sour, hard and dark crystals, and the washed colour. Following is a summary of the comments of the Committee, made by W. R. McAllep, the Chairman..

Polarization.—Since 1922 the average pol. has gradually increased, being now 97·95° ; but the amount of dark low polarizing sugars, which disturb refining operations seriously, has increased. No good reason exists for shipping sugar under 95° pol. from any factory. If such sugar is made, it should be remelted by the factory instead of passing the burden on to the refinery.

Sour Sugar.—Deteriorating sugar is classed as "sour" only when deterioration has not proceeded far enough to stain the bags, so that its amount is not an index of how much deteriorated sugar has been received. Four factories are responsible for almost 80 per cent. of it, and seven others for the remaining 20 per cent. If one could determine the amount of the resulting loss, conditions responsible for the deterioration would be corrected.

Hard Sugar.—Caking is not peculiar to the sugar industry, but our problem has special features. It is caused principally by an initial caking tendency due to supersaturation in the film of molasses on the crystals immediately after manufacture. During storage in the Islands, there is no trouble with caking, except under exceptional conditions, relative humidities being such that that sugar already caked will absorb moisture and soften. During shipment to the coast, however, i.e., when the sugar is transported by water from the tropics to a colder climate, conditions are not so favourable, the general tendency then being towards caking.

While this is so, the condition of the molasses film on the crystals immediately after manufacture is almost entirely responsible for the hard sugar problem. As the sugar cools, the film becomes supersaturated, the degree of supersaturation often being increased by evaporation from the film during cooling, so that the crystals become cemented together at the points of contact. If this initial hardening tendency is corrected, the amount of hard sugar reaching the refinery in non-boiler holds will be negligible.

When the sugar is to be stored for 2-3 months before shipment, corrective measures are unnecessary, for the sugar will usually soften during this time. When, on the other hand, sugar is loaded on a steamer within a few days, more or less caked sugar may be expected unless the sugar is cooled and the supersaturation of the film is corrected. Technical requirements can be met by allowing the sugar to cool in bins before bagging.

Caking is of course responsible for additional labour in the refinery " cut-in " station, for poorer results at the affination, and for considerable losses through damage to the bags. Besides this, the polarization is higher than the average of the shipment, and there is more or less difficulty in getting 100 lbs. of sugar into the 100 lb. bag, the sugar being usually sticky.

F.R. and Colour.—Both the filtration rate and the colour are functions of the colloid content of the sugar. If the non-dialysable matter in the massecuite taken up by the crystal could be reduced by appropriate pan operation, an improvement would be realized, but efforts towards this end have given negative results. Either more colloids must be removed during clarification, therefore, or else less non-sugar must be returned to the massecuites from which the commercial sugar is crystallized.

Improvements might be realized by increasing the *pH*, but this would mean providing additional clarification equipment. It seems certain that some improvement could be effected by closer supervision in drawing off the settled juice. Anyway, the lime-defecation method of clarification at best is only moderately efficient in flocculating and removing colloids. But, taking all factors into consideration, one will have to depend principally on reducing the amount of non-sugar returned to commercial sugar massecuite for further improvements, particularly where reasonably good clarification cannot be secured.

A system of boiling which reduces the average colloid concentration in the commercial sugar massecuites, and also reduces the total amount of massecuite boiled, has been recommended. It may be described briefly as boiling as many *A* strikes to which no molasses or remelt is returned, as is practicable, and sending all remelt and *A* molasses to the *B* strikes, the number of *B* strikes being kept as few as is practicable. This means a reduction in the re-processing of non-sugars, and much of the improvement in the colour during the past 5 or 6 years can be credited to it.

Indeed the amount of non-sugar so returned can be reduced to a negligible quantity. Carried to the limit this would mean producing all the shipping sugar from *A* massecuite, all after-products returned to these massecuites being in the form of melted washed sugar. All the low grade sugar and *A* molasses would be boiled into a *B* massecuite and the sugar washed before returning to the *A* massecuite. This would increase the amount of massecuite boiled, it is true, but it would improve the sugar to the maximum quality possible with a given quantity of syrup.

Double purging the low grade sugar is of course an expedient available, as it greatly reduces contamination of the commercial sugar massecuite and appreciably reduces the amount of massecuite that must be boiled. But as a rule sufficient centrifugal capacity is not available. Some factories, however, have a fairly liberal capacity in the commercial sugar centrifugals, so that if equipment were so arranged that any idle time could be utilized for this purpose more or less of the sugar could be double purged with these machines.

MR. BOMONTI'S INVESTIGATIONS.

The report also publishes a paper by H. F. BOMONTI, which presents in some detail the results of his work on the factors which bear on the quality of raw sugar, particularly on its filtration rate in the refinery. A summary of his paper here follows :—

Viscosity.—Studying the possible effect of varying viscosity on the rate of filtration, 50 per cent. solutions of raw sugars were prepared preliminarily by passing through coarse filter-paper. Their viscosity values were determined by noting the rate of flow from a 100 ml. pipette as compared with refined sugar as a standard. It was found, however, that the differences even between samples of widely different filtration efficiencies was exceedingly small and irregular. Actually, the solution of refined sugar took longer than any of the other samples.

Gums.—Organic matter insoluble in alcohol, so-called "gums," was determined on portions of a raw sugar solution after filtration through (*a*) filter-paper, (*b*) kieselguhr, and (*c*) semi-permeable membrane of nitrocellulose (i.e., ultra-filtration). It was shown thus that 65 per cent. of the "gums" is to be found in the filtrate after filtration through kieselguhr. Further that 45 per cent. of the "gums" actually pass through the semi-permeable membrane, being therefore either in true solution, or in an extremely fine state of division approaching molecular dimensions.

Colloids.—Following this, some work was done on the colloids of raw sugars with the ultra-microscope. The number of colloid particles per grm. of sugar was determined ; at the same time the filtration rate of that sugar was noted, some of the results found being as below, these showing that there would appear to be some correlation between the number of particles per grm. and the filtration efficiency.

Filtration Efficiency.	Particles per grm.	Filtration Efficiency.	Particles per grm.
97	$2 \cdot 9 \times 10^{10}$	67	$4 \cdot 2 \times 10^{10}$
95	3·0 ,,	55	7·7 ,,
77	3·2 ,,	55	13·0 ,,

These articles possess a negative charge, and experiments were made to endeavour to neutralize this by the addition of appropriate re-agents to reach the iso-electric point, and produce flocculation. Hydrochloric acid, potassium chloride, and calcium chloride were tried in varying amounts, but while they neutralized the electric charge there was only a slight indication of any flocculation after several days' standing. Alkalinized aluminium chloride, however, a highly positive colloid substance, when added to raw sugar solutions, heated to 50-60°C., produces flocculation almost instantanly givingeous a brilliantly clear solution. A large proportion of the colouring matter was thus removed at the optimum reaction for this reagent, thus indicating the colouring matter of raw sugar to be of a colloidal nature.

Boiling Methods.—It has probably been taken for granted that the major portion of the impurities retarding filtration are in the film around the crystal. Experiments with liquors made with liquors from entire raw sugars and from the crystal from these show clearly that with sugars having a low rate of filtration most of the retarding impurities are occluded in the crystal. Hence the importance of studying boiling methods to ascertain whether such occlusion can be controlled, and the following remarks are made :—

Non-dialysable matter, that is, the material which passes through a coarse filter-paper, but is retained on a semi-permeable membrane, is of special interest. There is some evidence that it is particles of this size which have the most deleterious effect on the filtration of sugar solutions. Data were collected showing that the temperature at which the massecuites are boiled does not influence the filtration rate of the sugar crystal. Nor does the density of the liquor as taken into the pan ; nor the density of the mother-liquor while crystallization is taking place. Other possible factors examined were the *pH* of the mother-liquor, and the type of feed, whether intermittent or constant, but the writer was not able to show whether these are beneficial or detrimental.

Economic Conditions within the U.S.A.—A British Report to the D.O.T. on Economic Conditions in the U.S.A. states that by the end of 1930 the output of the U.S. factories and mines had dropped to the lowest levels touched for a period of eight years and was only two-thirds as large as in the mid-summer of 1929 when the high points of the boom were reached. The year 1929, till the sudden deflation in security prices occurred, was one of too feverish prosperity supported by conditions that were abnormal and by security values that had been forced by superabundance of credit to unreasonable heights. It is being discovered now that the records of 1930 do not measure too unfavourably with those of 1928 and earlier years of more moderate returns, and there is a tendency to look for the bright spots on a clouded horizon. Whatever the moral lessons of a time of stagnation may be, the depression has provided an occasion for economists and producers alike to take stock of the position and to address themselves to ways and means of checking the tendency to over-development.

The Falkiner Cane Harvester in Florida.

By EARL L. SYMES.

During the 1931 milling season at Clewiston, Florida, fourteen of the new type Falkiner Mechanical Cane Harvesters were in operation. Nowhere in the sugar world have so many cane cutting machines been working on one plantation up to the present time. In spite of a very rainy harvest season the machines were not much delayed by this element. The rank growth attained by the cane on this rich muck soil, reaching in some cases 60 and 80 tons per acre, provided ideal conditions to learn just what the harvester could do. If it could operate successfully in the heavy growth of green tangled stalks with much lodging, it might be assumed that the harvester would give satisfactory results in other cane growing countries where the tonnage is usually less.

The machines were not used to cut the entire crop of cane, since labour was unusually abundant, due to the slackness prevailing in the industrial field. It may be stated, also, that the negroes in this part of the United States are learning how to cut cane now, and a good crew of four men will cut ten or more tons in a day in the heavy growth of thick canes such as POJ 2725,

FIG. 1. The Falkiner Harvester in Florida.

2714, etc. The erect growing varieties such as CO 281, which are tedious to cut by hand, are well suited to mechanical harvesting. It is of course difficult to work out comparative cost figures, since these will naturally vary with the variety of cane and its tonnage. It is quite possible that hand cutters will continue for some time to harvest the fields and varieties suitable to this type of labour. Of course if the ultimate machine costs prove to be lower on all types of cane, the manual cutting would be limited to fields which may be unsuited for the machines.

The Falkiner cane harvesters in Florida were used to cut about 86,000 short tons of cane in the 1931 season, in which the total cane milled at both Clewiston and Canal Point mills amounted to a little more than 350,000 short tons. The Canal Point mill was only operated a few weeks when it was decided to grind only at Clewiston.

Incidentally, the polarization of the cane at Clewiston averaged 8·94 with a yield of 7·67 calculated to a basis of 86 raw sugar ; the actual pol.

made was 97·41. Low sucrose and sugar yield were partially induced by the grinding early in the season of some Cristalina cane which had been affected by frost. This variety is to be abandoned. The POJ 2714 seems to have given the best results in the present season. With abundant moisture it seems characteristic of the 2714 to make an early rapid growth. Of course, the relatively high water table in this muck soil tends to retard ripening in all cane varieties to a certain extent. It may be possible to find some way to handle the individual fields so as to dry them out before harvesting. The heavy tonnage offsets the low sugar yield and the average production of sugar per acre over a period of years seems certain to exceed two tons as compared to 1·8 tons in Cuba during 1930 and about 1·2 tons in Louisiana. Yields up to 6·5 tons of raw sugar per acre have been obtained, so that it seems probable that the advantage over Cuba and Louisiana may be increased in the future.

The officials of The Southern Sugar Co. are very well pleased with the Falkiner harvesters and believe that the proper design has now been secured. The results in Cuba have also been satisfactory.

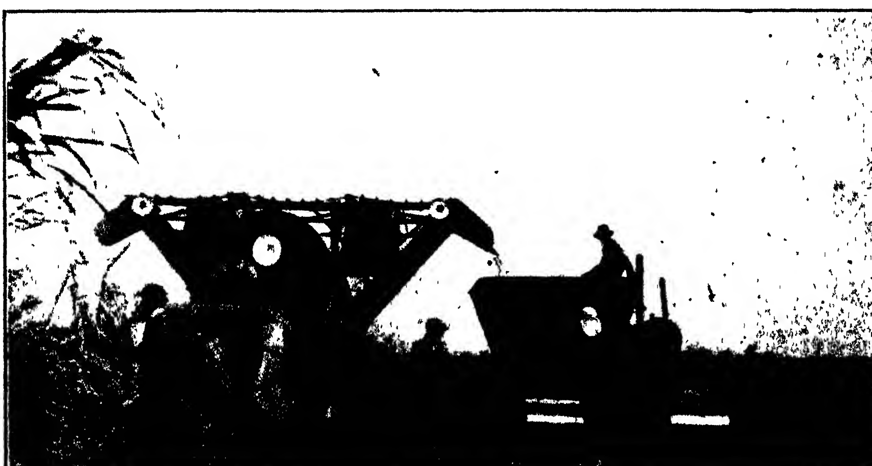


FIG. 2. The Falkiner Harvester at work.

The Falkiner Cane Harvester Corporation of America has acquired the United States and Cuban patent rights from Mr. Falkiner. It was reported that Mr. FALKINER was visiting England in July to make arrangements there for the manufacture and distribution of his harvester in other cane growing countries.

A plan to use Diesel motors on this harvester is also under consideration and it is quite possible that when ready for the market the purchaser may be permitted to select the type of motor desired, whether gasoline, alcohol or Diesel. The blower fan which separates the chaff and light weight top portions of the cane is powered by a small 25 H.P. motor which must operate at constant speed in order to maintain a definite air speed through the air tunnel. The main motor is 100 H.P. and of course operates at variable speed depending on the resistance offered by light or heavy growth canes and also the ground conditions.

The fact that no important changes are needed in the present type of machine indicates that at last a practical mechanical cane harvester capable of dealing with greatly varying cane field conditions has been developed.

*** Mr. FALKINER described his latest machine as something entirely different from anything that has hitherto been constructed, and is what he calls his "Push-over" or "Fender" type, that is, it pushes over the standing cane at an angle of 45 degrees as the machine enters the row of cane; thereby he claims to have solved the problem of picking up the large quantity of down and tangled cane met with amongst the upright cane in the fields. On entering the cane row the machine pushes over the standing cane, which is then cut level with the ground or below, as desired, by the ground knives, and the butts of the cane together with the trash are seized bythe feeding elevators, and are definitely drawn into the machine from any position in which they happen to stand or lie before it, as the machine advances along the row. When once the cut cane is seized by the butt, standing or fallen, crooked or straight, it cannot escape.

These feeding elevators virtually lick the cane and trash up from the ground knives (as they skim along the ground, rotating inwardly) and feed it into the chopper, which chops the mass of cane and trash into lengths of about 6 in. This chaff and cane is carried by an elevator from the chopper to the separating drum, which is provided with a powerful suction fan at the rear end. The drum rotates and is about 12 ft. long, and has a short stationary section in the centre, the front portion of the drum being provided with internal horizontal steps, which, as it revolves, carry the cane and trash up to the top, so that it is dropped from that position through the strong current of air induced by the suction fan at the rear. This air blast is so regulated that it carries out the trash and tops, leaving the solid cane which, owing to its weight, drops to the bottom of the drum and, finally, through an aperture in the bottom of the fixed centre section; while any solid cane that is carried past the aperture by the air suction is caught by the internal spiral slats which are fastened in the back half of the drum and act as conveyors as it rotates, so that this cane also is delivered into the aperture in the fixed section under which the loading elevator is arranged, which rises up and outward on either side, with a reverse gear to its action, so that it can load either right or left into the box carts drawn by a tractor alongside for the purpose of removing the clean cane to the mill.

The chassis is mounted on wheels of the tracklaying type of suitable dimensions, which are driven by a 100 H.P. gasoline or Diesel motor, which motor also operates the ground knives, chopper, elevators, etc. A separate 25 H.P. engine drives the suction fan at a constant speed.

In the accompanying illustrations, Fig. 1 is a side view taken in the fields at Clewiston, Florida. Fig. 2 is a front view, showing the tractor hauling a 5-ton box cart and so illustrating the method of loading. When full, the box cart is hauled by the tractor to an adjacent rail car, the box being lifted off the cart by a trestle and tackle and its contents dumped into the rail car.

JAVA SUGAR PRODUCTION.[1]—During 1930 the factories in Java produced 29,158,660 quintals of sugar calculated to crystal, this being made up as: Superior head sugar 20,478,390 q.; superior syrup sugar, 81,311 q.; No. 16 D.S., and higher, 8,020,420 q.; No. 12 to 14 D.S. (Muscovados), 30,504 q.; molasses sugar, Nos. 8-10, 667,016 q.; molasses sugar, 10-12, 390,557 q.; centrifugal sack sugar, 3713 q.; sacked sack sugar, 3952 q.; others, 32,492 q.

1 *Archief*, deel III, Mededeelingen, 1931, No. 8.

The Brussels Sugar Convention of 1931.

Text of the Agreement.

We give below in full the nine Articles of the agreement, in the belief that these will rank historically with the articles of the 1902 Brussels Sugar Convention. Preceding these Articles there is a detailed description of the Parties subscribing to the agreement, of which what immediately follows here is a summary.

The Agreement is between the Cuban Sugar Stabilization Institute (a Cuban Corporation); the Association of Java Sugar Manufacturers for the Determination of Export Quota under International Agreement (called "Visoco" for short); the Economic Union of the German Sugar Industry; the Central Association of the Czechoslovak Sugar Industry; the Polish Occidental Sugar Industry Association in Poznan; the Professional Association of Sugar Factories of the former Kingdom of Poland in Warsaw; the Hungarian Sugar Manufacturers Association; and the Belgian Sugar Producers. These parties are acting in the interests of the sugar industries of their respective countries, and each is a corporation duly organized under the laws of its own country. In the case of Cuba, Java and Germany legal enactment had already been obtained to assist in enforcing the sugar agreement; in the case of the other countries the respective parties agree to use their best efforts for the prompt enactment of such measures.

ARTICLE I: EXPORTS.

(a) The Cuban Corporation agrees that exports of sugar from the Republic of Cuba to countries other than the United States of America shall not exceed the following respective quotas in each of the five calendar years beginning with January 1st, 1931 to and including December 31st, 1935, i.e. :—

	Long Tons.
1931	655,000
1932	805,000
1933	855,000
1934	855,000
1935	855,000

Sugars, exported or re-exported from the United States of America, shall, for the year in which such exports or re-exports occurred, to the extent that the same exceed the imports of sugar in such year to the U.S.A. from countries other than the U.S.A. and Cuba, be deducted from the export quota as fixed above for Cuba to countries other than the U.S.A.; any amount by which Cuba's exports to such other countries were not reduced as hereinbefore provided (because of the exports or re-exports from the U.S.A. occurring too late in the year to permit of a reduction of Cuba's exports or otherwise) shall be deducted from the export quota of Cuba to such other countries for the following year. Exports of low grade sugar, so called dry sugar or muscovados, not polarizing above 88 per cent., from the Philippine Islands to China and/or Japan, shall not be considered as exports from the U.S.A. under this Agreement to the extent of 10,000 long tons annually. Sugars produced in the U.S.A. and sugars imported into the U.S.A., which are exported or re-exported from the U.S.A. to countries other than the U.S.A., after being refined in the U.S.A., shall, for the purpose of this paragraph, be converted into the equivalent of Cuban raw sugar to ascertain the quantity so exported or re-exported. The U.S.A., for the purposes of this Agreement, includes not only the 48 individual states and the District of Columbia, but as well the present possessions of the U.S.A., including the Philippine Islands, Hawaii, Porto Rico, and the Virgin Islands, but as to each such possession only for such period (whether or not it continues to be a possession of the U.S.A.) as sugar produced in such possession may be imported into the territorial U.S. either free of duty or subject to a preferential tariff. Imports, exports and re-exports mentioned in this paragraph shall be ascertained from the official Government statistics of the U.S.A.

(b) The Java Corporation agrees that the exports of sugar from Java in each of the five years beginning with April 1st, 1931, to and including March 31st, 1936, shall not exceed the following respective quotas :—

		Metric Tons.
1931-32	April 1st to March 31st	2,300,000
1932-33	,, ,, ,,	2,400,000
1933-34	,, ,, ,,	2,500,000
1934-35	,, ,, ,,	2,600,000
1935-36	,, ,, ,,	2,700,000

The increase in the quota of exports for Java above 2,300,000 metric tons beginning with April 1st, 1932, is subject to the condition that if in any of the four years beginning with the last mentioned date there are accumulated additional stocks of Java sugars by reason of the inability of Java to export its export quotas for such year above provided, then it is agreed that Java shall take measures purposing to adjust its production accordingly when planting its next year's crop ; the intent being that the production of Java will not, by reason of the cumulative annual increases in its quota above provided, be so increased that additional surplus stocks will be accumulated.

(c) The German Corporation, Polish Corporations, the Hungarian Corporation and Belgian Producers respectively agree that the exports of sugar from their respective countries for each of the five years beginning with September 1st, 1930, shall not exceed the following respective quotas :—

	Metric Tons.
Germany, for the year beginning September 1st, 1930	500,000
Germany, for the year beginning September 1st, 1931	350,000
Germany, for the year beginning September 1st, 1932	300,000
Germany, for the year beginning September 1st, 1933	300,000
Germany, for the year beginning September 1st, 1934	300,000
Poland annually	308,812
Hungary annually	84,100
Belgium annually	30,275

The Czechoslovakian Corporation agrees that the exports of sugar from Czechoslovakia for each of the five years beginning with October 1st, 1930, shall not exceed 570,817 metric tons.

(d) Inasmuch as the five-year period of this Agreement for Germany, Poland, Hungary and Belgium expires September 1st, 1935, such date shall likewise be the termination date hereof for Cuba, Java and Czechoslovakia. The quota of exports for Cuba to countries other than the U.S.A. for the period January 1st, 1935, to September 1st, 1935, shall be such proportion of the quota fixed for Cuba for exports to countries other than the U.S.A. for the calendar year 1935, as the total actual quantity of exports of sugar from Cuba to countries other than the U.S.A. during the respective periods from January 1st to September 1st, for the four calendar years 1931 to 1934, is to the total actual exports of sugar from Cuba to countries other than the U.S.A. during the total four-year period beginning January 1st, 1931.

The export quota of Java for such period April 1st, 1935, to September 1st, 1935, shall be such proportion of the total quota above fixed for the period from April 1st, 1935 to April 1st, 1936, as the total actual quantity of exports of sugar from Java during the respective periods from April 1st to September 1st for the four calendar years 1931 to 1934, is to the total actual exports of sugar from Java for the four-year period beginning April 1st, 1931.

The export quota of Czechoslovakia for such period October 1st, 1934, to September 1st, 1935, shall be such proportion of the annual quota of Czechoslovakia, as the total actual quantity of exports of sugar from Czechoslovakia during the four periods of eleven months, i.e. :—

1930-1931	October 1st to September 1st	1932-1933	October 1st to September 1st and
1931-1932	,, ,,	1933-1934	,, ,,

is to the total actual exports of sugar from Czechoslovakia for the entire four-year period from October 1st, 1930, to October 1st, 1934.

(e) If, in any quota year for which an export quota is fixed for any country in this Article I, the actual exports from such country shall be less than such quota, the deficiency shall not be added to nor affect any subsequent quota year; it being understood that each quota year shall be separate and independent of any other quota year; provided, however, that if, in any quota year the shipment or transporation of sugar within or from any of the countries mentioned in this Agreement is interfered with by reason of strike, fire, internal disturbance, ice or high or low water in waterways, Act of God or similar *force majeure* (other than destruction or shortage of crops and/or sugar from any cause), the International Sugar Council shall have power to determine whether or not and the extent to which such *force majeure* prevented the export of the quota allotted to such country for such quota year. If the Council determines that any such *force majeure* prevented the export of the quota of such country during such period, then the quantity of sugar which such country was so unable to export as determined by the Council, shall be added to its quota for the following quota year.

(f) Except as provided in Article VI, no transfer of quotas from one country to another shall be permitted.

ARTICLE II: SURPLUS STOCKS AND PRODUCTION.

(a) It is agreed that part of the exports from the respective countries each year (within the limits of the respective quotas herein set forth) shall consist of surplus stocks on hand in the several countries, and that as far as possible the production of such countries shall be adjusted during the term of this Agreement, so that it will not exceed the local consumption of the respective country plus its export quota (and in the case of Cuba, plus its exports to the U.S.A.), less the quantity to be taken from the surplus stocks as herein provided, so that all surplus stocks of said countries will have been eliminated in the course of the respective five-year periods above mentioned.

(b) There has been organized in Cuba, *Compania Exportadora Nacional de Azucar* (The National Sugar Exporting Corporation), pursuant to the Sugar Stabilization Law approved November 15th, 1930. Said corporation on January 1st, 1931, held or had contracts for the acquisition of approximately 1,300,000 long tons of sugar from the old crops. Of this amount it is intended to export, during 1931, 260,000 long tons. In addition, there were additional surplus stocks of sugar of the past crop on January 1st, 1931, which were taken into account in ascertaining the total amount of the crop fixed by the President of the Republic of Cuba for 1931, pursuant to his Decree dated January 31st, 1931.

(c) The Java Corporation agrees that the surplus stocks of sugar in Java on April 1st, 1931, were approximately 500,000 metric tons; and further agrees that if the sugar produced from the crop to be harvested in Java in the year beginning April 1st, 1931, exceeds the total of (a) 2,200,000 metric tons and (b) the amount of sugar consumed in Java during such year, the excess will be segregated and included in the sugars to be exported from Java during the following four years of this agreement (within the limits of its respective quotas above provided) and the production of Java in such four years limited as hereinafter provided.

(d) The German Corporation, Czechoslovakian Corporation, Polish Corporations, Hungarian Corporation and Belgian Producers, respectively, agree that the respective surplus stocks of sugar in their respective countries on September 1st, 1930, aggregated the quantities respectively set forth below, i.e. :—

	Metric Tons.
Germany	84,000
Czechoslovakia	9,000
Poland	80,000
Hungary	16,199
Belgium	29,000

and that after providing for (a) their respective effective exports, but not in excess of their respective quotas permitted by this Agreement, for the year beginning Sep-

tember 1st, 1930, and (b) the respective quantities consumed in their respective countries in such year, there will be retained in each country as a surplus stock, the excess of sugar produced from the crop harvested in the year beginning September 1st, 1930, as well as said surplus stocks existing on September 1st, 1930, such surplus to be exported in accordance with the provisions of the following paragraph (e), provided however, that the dates mentioned in this paragraph shall, in the case of Czechoslovakia, be October 1st, 1930, instead of September 1st, 1930.

(e) The amount to be exported from each country annually, as set forth in Article I, shall consist, either in whole or in part, of surplus stocks above set forth and/or of new sugars produced currently, the parties intending, however, that the surplus stocks of each country shall, in the course of the respective five-year periods above mentioned, be entirely disposed of and eliminated by being included either in the quantities consumed in the respective country or in its export quota. The parties respectively agree that as far as possible the production of sugar in their countries shall be adjusted beginning with the coming year's sowings, plantings or harvesting, so that such production shall, with the portion of the surplus stocks of such country to be disposed of annually, equal the local consumption of such country plus the amount of the export quota allotted to such country; the intent being that the surplus stocks in the European countries existing on September 1st, 1931 (in the case of Czechoslovakia, October 1st, 1931) shall be decreased at least approximately at the rate of 25 per cent. for each of the remaining four years of the Agreement; the surplus stock of Java existing on April 1st, 1932, likewise to be reduced at least approximately at the rate of 25 per cent. for each year from that date; the segregated stock in Cuba to be reduced at the rate of at least approximately 260,000 long tons per annum; so that all such surplus stocks shall be practically eliminated during the period of this Agreement and no additional surplus stocks created. In any country, however, there may be substituted for sugars included in existing surplus stocks a like quantity of sugar from the crop of said country in any quota year, provided that no such substitution shall operate to increase the quantity to be exported by such country in any quota year as hereinbefore provided in Article I, nor operate to increase the surplus stocks of such country above the quantity contemplated by this Article after deducting from such stocks the amount by which such stocks are to be decreased annually as above provided. If any one of the countries, for any reason, does not produce a crop large enough (after providing for its local consumption) to provide for its total export quota for such year after taking into account the quantity to be taken from its surplus stocks, such country may provide the deficiency from the surplus stocks without affecting the right of such country in future years to its export quota hereinabove provided for such future years.

The Java Corporation agrees to take measures to the effect that the production of its members will be limited in accordance with the foregoing principles, so that additional surplus stocks will not be created and that their present surplus stocks will be practically eliminated. Said Corporation will use its best endeavours to have legislation passed in Java as early as practicable to require the Java producers, who are not members of the Corporation, similarly to adjust their production.

Inasmuch as this Agreement does not control the exports of Cuba to the United States of America, it is understood that the foregoing provisions of this section (e) are not intended, so far as Cuba is concerned, to limit the export of its segregated or surplus stocks to countries other than the U.S.A., but that the same may be exported, in whole or in part, to the U.S.A., and it is further understood that the production of Cuba will be limited to the total quantity necessary to provide for its home consumption, its exports to countries other than the U.S.A., and its exports to the U.S.A., to the extent that said home consumption and exports are not provided for by the amount to be taken annually from the segregated stocks of Cuba as above provided.

The Cuban Corporation agrees that on September 1st, 1935, the Cuban Producers will not have in the U.S.A. stocks of sugar in excess of the normal and usual stocks of sugar usually maintained by them in the U.S.A. for the requirements of the markets of the U.S.A.

ARTICLE III: DEFINITIONS.

The term "exports" as used in this Agreement in connection with the exports of the respective countries of the parties to this Agreement, means net exports from such countries respectively.

Sugar imported in bond for refining purposes into any of the countries represented in this Agreement, or into the U.S.A., will not be considered as having been imported as long as it remains in bond: likewise such sugar being exported after refining will not be considered as export under this Agreement; provided that the foregoing clause does not apply to Cuban sugars imported into the U.S.A. Government statistics as to the foregoing shall be furnished by the respective parties.

As export of sugar from Poland shall be considered all sugar that has left the territory falling under the Polish laws re excise and re the regulation of the turnover of sugar.

As long as the present Customs Union between Belgium and Luxembourg continues in effect, Belgium and Luxembourg shall be considered as one country for the purposes of this Agreement.

The term "long tons" as used in this Agreement shall mean 2,240 pounds avoirdupois weight.

The term "metric tons" as used in this Agreement shall mean 1000 kilograms.

The respective exportable quantities of sugar heretofore mentioned shall, in the case of Cuba and Java, mean and refer to the nature and the types of sugar heretofore exported by such countries respectively; and, in the case of the European countries above mentioned, shall mean raw sugar, Tel Quel, European white sugars to be converted to a raw basis at the rate of nine parts white to ten parts raw. Such quantities shall, in all cases, mean net weight excluding the container.

The word "sugar" as used in this Agreement shall be deemed to include sugar in any of its commercial forms, except the product sold as final molasses, and also the so-called "Goela Mangkok" sugar produced by primitive methods by natives of Java for their own account, to which sugar the Java Government does not extend its legislative measures.

Statistics.

The parties agree to furnish the International Sugar Council hereinafter provided for, with official government statistics of their respective countries immediately after the publication thereof, showing the total quantities of sugar exported and imported in each month and the form in which such export or import was made, and in the case of European beet countries the equivalent thereof in raw sugar, and also in each case as far as possible the destination of said exports respectively; provided, however, that as to Java, the Java Corporation will furnish unofficial statistics respecting the foregoing matters as early as practicable, and will furnish the official Government statistics as soon as possible after the publication thereof. There shall also be furnished similarly statistics as to production and estimated stocks. Any revision or correction of said statistics shall likewise be promptly submitted to the International Sugar Council. Within thirty (30) days after the execution of this Agreement, the respective parties shall also furnish such statistics for the calendar months of the term of this Agreement which shall have preceded the formal execution and delivery thereof. If any party fails to furnish any such statistics, the International Sugar Council shall procure the same from such source as it considers reliable. The International Sugar Council may specify the forms to be used for the furnishing of the statistical information by the parties.

ARTICLE IV: INTERNATIONAL SUGAR COUNCIL.

(*a*) There is hereby created an International Sugar Council (herein referred to as the "Council") representing the parties to this Agreement, which shall consist of three members for the industry of each of the countries represented in this Agreement, except that the Czechoslovakian Corporation may appoint as many members as it considers advisable, provided, however, that the members representing the industry of each country shall designate in writing to the Chairman of the Council one member who shall, at meetings of the Council, cast the vote of the party or parties representing such industry, and shall also designate an alternate to act in the absence

of the member so designated. The party or parties representing in this Agreement the industry of each country shall appoint their said representatives on the Council, and in addition shall appoint three further members, who shall act as alternates in their order of appointment in the absence or disability of any of the regular members representing such party or parties on the Council. Upon the execution of this Agreement, the party or parties representing the industry of each country shall deliver an instrument duly executed by such party or parties, setting forth the names of its appointees and alternates to the Council. Any member of the Council or alternate may be removed at any time by the party or parties who appointed him. If any member of the Council should die or become disabled or resign or fail to act or be removed, the party or parties appointing such member shall promptly select a successor, so that such party or parties may be duly represented at all meetings of the Council.

The Belgian Producers respectively agree that in case it is necessary to fill a vacancy in their representatives upon the Council, they shall, as early as possible, call a general meeting of their producers, which meeting shall, by a majority vote, fill the vacancy.

(*b*) The Seat of the International Sugar Council shall be at The Hague, at which place an office is to be maintained during the term of this Agreement. Meetings of the International Sugar Council shall be held in Europe at the place designated by the Chairman from time to time.

(*c*) Regular meetings of the Council shall be held quarterly on the second Monday of March, June, September and December.

Special meetings may be called at any time either (*a*) by the Chairman of the Council, in his discretion, or (*b*) upon the written request of the members of the Council representing the industries of two countries, which request shall state the purpose of the meeting and be delivered to the Chairman of the Council, the time for such special meeting to be at least twenty days but not more than thirty days after such request has been so delivered. Such request shall be sufficient if signed by at least two of the members of the Council representing the industry of each of said two countries. Upon the receipt of such request, the Chairman shall cause notice of such meeting to be given as hereinafter provided.

(*d*) The Chairman of the Council shall cause a notice of all meetings, regular and special, to be given in writing by mail and cable to each member of the Council, at his regular address, at least fourteen days before the date for the meeting. Such notice shall state the matters to be brought before the meeting. Any two members of the Council may, in writing, request the Chairman thereof, at least twenty days before any regular meeting, to incorporate in the notice of such meeting, any matters or purposes within the powers of the Council, for consideration at the meeting, and the Chairman shall thereupon incorporate in such notice such matters or purposes. Only matters stated in the notice of each meeting may be considered thereat, unless all of the parties to this Agreement are represented at such meeting and otherwise consent.

(*e*) The number of votes which the respective parties shall be entitled to cast at each meeting of the Council through their respective representatives shall be as follows :—

	Votes.
The Cuban Corporation	35
The Java Corporation	30
The Czechoslovakian Corporation	8
The German Corporation	6
The Polish Corporations, jointly	6
The Hungarian Corporation	3
The Belgian Producers, jointly	2
Total	90

(*f*) At all duly-called meetings of the Council, the members of the Council who are present shall constitute a quorum (regardless of the number of votes to which such members are entitled), and a majority of the votes present at any meeting shall be

sufficient to authorize any and all action taken at any such meeting, except in the following instances, which shall require the respective votes hereinafter specified :—

(1) The first resolution adopted by the Council shall not be modified, altered or repealed, except by the unanimous vote of the Council. Likewise the unanimous vote of the Council shall be required to modify, alter or repeal any other resolution of the Council which has been adopted upon the condition that it shall not be modified, altered or repealed except by such unanimous vote.

(2) Action taken for the increase of quotas under the provisions of paragraph (*g*) of Article V shall require fifty-five (55) votes.

(3) Any arrangement or agreement contemplating the admission as a party to this agreement of the industry of any other country than the countries originally represented herein, shall require the unanimous vote of the Council, as provided in Article VII.

(4) Action referred to in the second paragraph of Article VII shall require fifty-five (55) votes.

(5) The appointment of arbitrators under the provisions of paragraph (*a*) ot Article VIII shall require the unanimous vote of the Council.

(6) Action taken under paragraph (*e*) of Article VIII shall require three-fourths ($\frac{3}{4}$) of all the votes allotted to the respective parties under Article IV, excluding the party or parties representing the country from which it is claimed the excess of exports was made, which majority to be sufficient shall consist of the votes allotted to the parties acting for the industries of at least two-thirds of the countries represented in this Agreement, excluding the country from which such excess of exports is claimed to have been made.

(*g*) Any party or parties representing the industry of any country may, by special power of attorney signed by at least two (2) of the Members of the Council representing such party or parties, authorize any Member of the Council representing another party to cast at a meeting of the Council the votes which the representatives of such party or parties are entitled to cast at such meeting, such written instrument to be filed with the Chairman of the Council.

(*h*) The Council may act without a meeting by written instrument signed by Members of the Council as hereinafter provided. Whenever any such action is proposed to be taken by written instrument, the Chairman shall give notice thereof to each member of the Council by registered mail. If, within fourteen (14) days after the mailing of such notice, the Member of the Council entitled to cast the vote of any party or parties does not approve such instrument but instead delivers to the Chairman his written demand that a meeting of the Council be called to consider the proposal, then the proposed action cannot be made effective by such written instrument, but must be submitted, to a meeting of the Council which the Chairman shall then immediately call, but if no such demand is presented to the Chairman within said period of fourteen (14) days, then the proposal shall be effective if and when such written instrument is approved in writing by Members of the Council authorized to vote for parties entitled to a total of fifty-five (55) votes, or such greater vote as may be specifically required by this agreement for the proposed action : provided, however, that if such written approval is not given within a period to be fixed by the Chairman in requesting approval as aforesaid, the proposal shall be considered to have been rejected. The Chairman shall notify all parties of any action taken by the Council pursuant to this paragraph.

(*i*) *Powers.* The Council shall have the following powers :—

(1) The supervision of the operation of this Agreement.

(2) The collection of statistics and information respecting the production, consumption, stocks and requirements of the countries of the several parties to this Agreement, as well as all other countries.

(3) The study of the progress or retrogression of sugar consumption and the reasons therefor.

(4) The study of ways and means for the increase of the consumption of sugar in the world.

(5) The recommendation to parties to this Agreement of measures for the improvement, development and/or control of production and consumption.

(6) The publication, at regular intervals, of accurate statistics regarding the world situation of sugar, and to suggest to the parties steps to be taken respecting the adjustment of production with actual needs and exports and to improve the method of selling and marketing.

(7) The consideration and discussion with producers of countries not represented by the parties to this Agreement, of measures of mutual interest and to enter into agreements providing for arrangements with such producers as provided by Article VII hereof.

(8) The appointment of an Honorary President, Chairman and Secretary, as well as statisticians, attorneys, accountants, and such additional staff as may be necessary to carry on the work of the Council, subject, at all times, to the control of the Council. Any appointee of the Council may be removed at any time by the Council with or without cause. The powers and duties of its respective appointees shall be designated by the Council from time to time.

(*j*) The Honorary President shall be selected from the members of the Council for a term of one year, and shall preside at all meetings of the Council. In his absence, the meeting shall designate a temporary president.

(*k*) The Chairman need not be a member of the Council. He shall supervise and direct the activities of the Council in the intervals between the meetings of the Council, but at all times subject to the advice and control of the Council, and shall perform such other duties as are designated by the Council from time to time. The Secretary and other appointees of the Council shall perform such duties as the Council and/or Chairman may designate from time to time.

(*l*) The parties shall contribute to the expenses of the Council in the same proportion as the votes allotted to them respectively. The payments to be made each year shall be made in two semi-annual equal instalments on January 15th and July 15th of each year. One-half of the sum payable for the year 1931 shall be paid upon the execution of this Agreement, such payment to be made to the order of Nederlandsche Handel-Maatschappij, N.V., of The Hague, as Trustee, under the terms of this Agreement, to be paid and disbursed upon the written order of a majority of the members of a committee of three (to be known as the Finance Committee) who shall be appointed at the first meeting of the Council from the members of the Council; but the members of the Finance Committee may be removed and superseded at any time by the Council, who shall have the right to fill all vacancies in such Finance Committee. Such moneys shall be used to pay all expenses connected with the activities of the Council, and if on September 1st, 1935, any moneys remain after providing for all obligations, liabilities and expenses incurred by the Council, the same shall be refunded to the parties in proportion to their respective contributions.

(*m*) The members of the Council shall not be liable for any acts or agreements or contracts made by the appointees or employees of the Council. No member of the Council shall be responsible for any act or omission of any other member, nor for anything done by him, except in bad faith.

Article V : Increases of Quotas.

The purpose of this Agreement is to restore a normal price for sugar but not more than a normal price in the world market. To the end that the plan of segregation and reduced production set forth in this Agreement may not operate through creating higher than normal prices, to encourage further surplus sugar production, the following plan of increasing export quotas is provided for.

(*a*) The respective annual export quotas of each country shall be increased five per cent. (5%) in the event of the world price for raw sugar, basis 96 degrees of polarization, reaching, for the prescribed period, the equivalent of two cents (2 c.) United States currency per English pound, free on board Cuba, for prompt shipment as hereinafter defined.

(*b*) If the said world price reaches, for the prescribed period, two and one-quarter cents (2¼ c.) United States currency, the International Sugar Council may, at its discretion (but without obligation), increase the export quotas by an additional

two and one-half per cent. (2½%). If, however, the said world price reaches two and one-half cents (2½ c.) United States currency for the prescribed period, the International Sugar Council shall increase the said quotas respectively by an amount which, with the increase (if any) made after the price reached two and one-quarter cents (2¼ c.) shall equal five per cent. (5%) of the said quotas.

(*c*) For the purpose of this Agreement, the world price shall be understood to mean the quotation of the London Terminal Raw Sugar Market for sugar basis 96 degrees polarization, cost, freight and insurance (c.i.f.) United Kingdom, calculated back to free on board (f.o.b.) Cuba by deducting the current rate of freight and insurance and converted to United States currency at the current rate of exchange. The respective prices referred to shall be considered to be reached whenever the average price over a period of thirty (30) consecutive market working days shall not be less than the equivalent named. The quotations to be taken shall be the average price of business done on the three daily calls, or failing business done, the average of buyers and sellers quotations. The month of delivery on which the quotations are to be based shall be the second month from the current months (for instance, during January the March quotation to be taken ; during February the April quotation, and so on) from which basis the premium for carrying charges, to be computed at 1½d. per hundredweight (cwt.) shall be deducted.

(*d*) Notwithstanding the foregoing, if Java producers have sold consecutively quantities aggregating 400,000 metric tons at an average price of not less than 12 guilders per 100 kilos for Java whites, first cost (free warehouse Java ports), before the said two cents world price calculated above has been reached for the prescribed period, as provided in paragraph (*a*), the International Sugar Council shall regard this as equivalent to the said price of two cents having been reached for the purpose of this Agreement, and shall release the said increase of five per cent. (5%) referred to in paragraph (*a*). Sales of Java low grades are to be adjusted to the basis of whites by adding to the sales price of low grades one (1) guilder per 100 kilos in the case of brown sugars and one and one-quarter (1¼) guilders per 100 kilos in the case of muscovados.

Consecutive sales by Java producers of quantities aggregating 400,000 metric tons at an average price of not less than thirteen and a half guilders (f. 13·50) and fifteen guilders (f. 15), respectively, per 100 kilos for Java whites, first cost (free warehouse Java ports), will have the same effect as prices of 2¼ c. and 2½ c. respectively under the terms of paragraphs (*b*) and (*g*) of this article V.

In case the Java producers in any calendar year sell sugar of the crop of the next calendar year, such sales shall, for the purposes of this paragraph (*d*), be considered as the first sales of the year when such crop is harvested.

(*e*) The International Sugar Council shall obtain, in such manner as it shall determine from time to time, daily information giving the London official prices, freight and insurance rates, and calculation of free on board Cuba equivalent, as well as information as to Java sales, the Java Corporation to furnish information as to sales made by its members and as far as possible by outsiders.

(*f*) Only one increase of five per cent. (5%) under paragraph (*a*) of this Article V, shall be permitted in each calendar year beginning with 1931 ; and the additional releases under paragraph (*b*) above, shall not exceed, in the aggregate, five per cent. (5%) in any calendar year. Sixty (60) calendar days will have to elapse between two periods of thirty (30) market working days in order to involve for each of them an automatic increase of the quotas of 5 per cent., when such periods do not end within the same calendar year. This does not apply to the stipulations as to Java sales aggregating 400,000 metric tons provided for in paragraph (*d*).

(*g*) After and while the world price for raw sugar, as defined in the preceding paragraphs (*a*) and (*c*), remains at an average above two and one-half cents (2½ c.) for the prescribed period or longer, the International Sugar Council shall have power to determine whether and the conditions under which increases in the quotas additional to those above provided shall be released and the respective amounts thereof : any such decision to require fifty-five (55) votes in the Council.

(*h*) The basis for the calculation of each increase of quotas for each country shall be its export quota for the twelve (12) months commencing with the date of the increase, the quota for each such month to be taken as one-twelfth ($\frac{1}{12}$) of the quota

of such country fixed in Article I for the quota year in which such month falls; the percentage of each increase shall be the same for each country. Each increase in quotas under this Article only affects the quota for the period of twelve months aforesaid, and no subsequent period.

The International Sugar Council shall at the time of each increase fix the period within which said increase is to be exported, and when doing so shall be guided by the principle that sufficient time shall be allowed to every participant to market its increase and, if necessary, to produce the required sugar, taking into account the difference in time for the various participants between sowing or planting, and harvesting.

ARTICLE VI.

In case Germany in any year is unable to export its export quota, such deficiency up to the following respective quantities in each of the five years, i.e. :—

	Metric Tons.
The year beginning September 1st, 1930	300,000
The year beginning September 1st, 1931	150,000
The year beginning September 1st, 1932	100,000
The year beginning September 1st, 1933	100,000
The year beginning September 1st, 1934	100,000

shall be divided between Cuba, Czechoslovakia, Poland, Hungary and Belgium in the following respective proportions :—

Cuba	575/750ths
Czechoslovakia	96/750ths
Poland	56/750ths
Hungary	17/750ths
Belgium	6/750ths

In the event that the countries last mentioned become entitled to export any deficiency in the quota of Germany under the foregoing provisions, the International Sugar Council shall fix the period within which such other countries shall be entitled to export said deficiency and, in doing so, shall be guided by the principles outlined in the last paragraph of Article V of this Agreement.

ARTICLE VII : ADHERENCE OF THE SUGAR INDUSTRIES OF OTHER COUNTRIES.

The parties have entered into this Agreement for the purpose of stabilizing their industry and curing the difficulties with which it has been faced. They expect other producing countries to co-operate and many of those countries have evidenced their desire to participate in the purposes of this Agreement. Therefore, the Council shall take steps to agree as soon as practicable with the sugar industries not represented by the parties to this Agreement, so that they may contribute their share to the task of bringing about a better balance between the supply and consumption of sugar in the world. Any such arrangement shall be covered by supplemental agreement and may contemplate or involve the admission as a party to this Agreement of the industry of any such other country either upon the terms set forth in this Agreement, or upon other terms to be approved by the Council, or any such supplemental Agreement may be a special one not involving the admission of such industry as a party to this Agreement : provided that any such arrangement shall require the unanimous vote of the Council. Any party so admitted to this Agreement shall, for all purposes, except as limited by said supplemental Agreement, be considered a party to this Agreement.

If, despite the sacrifices and efforts of the parties hereto as well as such other countries as may become parties to this Agreement, in the opinion of the International Sugar Council any measures should be taken by a producing country (not participating in this Agreement) to prevent restoration of normal and economic conditions in the world sugar market, the Council with the approval of members entitled to cast fifty-five (55) votes, shall take such action as they shall consider necessary for the protection of the interests of the parties to this Agreement.

ARTICLE VIII : ARBITRATION.

(a) The International Sugar Council shall, at its first meeting, elect a board of three arbitrators, and also a first, second and third alternate to act in the order of

their election in case of the death, incapacity or failure to act of any member of the Board of Arbitration : such arbitrators to be selected by the unanimous vote of the Council.

If any member of the Board of Arbitration or any alternate should resign, die or become incapacitated, the Council shall, by unanimous vote, elect a successor, who shall take the place of such member of the Board or alternate.

The Council may, in its discretion, authorize the payment to the arbitrators and alternates of an annual retainer, and also additional compensation when actually engaged in an arbitration.

(*b*) In case the party or parties representing the industry of any country should claim that the exports of sugar covered by this Agreement from any of the countries represented herein exceed the quota hereinbefore fixed for such country for the quota year in question, such party or parties shall notify the Chairman of the International Sugar Council in writing of such fact, and thereupon the Chairman shall notify the party or parties representing the country the exports from which were so claimed to have exceeded the quota, which notice shall be in writing and shall be given by registered mail to the members of the Council acting for such party or parties. The notice shall specify the quantity by which the exports are claimed to have exceeded the quota and the period when such export quota was exceeded.

(*c*) The party or parties so notified, within thirty days after receiving the notice, shall, by written notice to the Chairman, either deny or admit the claim that such quota was exceeded. In case such party or parties deny that the quota was exceeded, or fail to notify the Chairman with regard thereto, the Chairman shall submit to the Board of Arbitration hereinbefore provided the question whether or not for the year involved the exports from such country (for Cuba its exports to countries other than the U.S.A.) exceeded its quota for such year.

(*d*) The Board of Arbitration shall be entitled to make such investigation as it deems proper in order to determine the question to be decided and to obtain all necessary information from any party or parties to this Agreement with respect thereto. The Board of Arbitration shall give to the parties hereto full opportunity of being heard and presenting any facts in regard to the question.

As soon as practicable after the completion of the investigation and hearings of the Board of Arbitration, it shall submit its decision in writing to the Chairman of the International Sugar Council. The decision of two of the three arbitrators shall govern.

If the decision of the Board of Arbitration shall find that the exports of the country involved exceeded the quota in question, the decision shall also specify the extent by which such quota was exceeded.

(*e*) Upon receipt of such decision of the Board, or if the party or parties representing the country involved admitted that the exports in question from such country exceeded its quota, the Chairman shall call a special meeting of the Council for the purpose of considering the action to be taken by the Council with respect to such decision of the Board of Arbitration or such admission. Such action shall require the approval of three-fourths (¾) of all the votes allotted to the respective parties under Article IV, excluding the party or parties representing the country from which the excess of exports is claimed to have been made, which majority to be sufficient shall consist of the votes allotted to the parties acting for the industries of at least two-thirds of the countries represented in this Agreement, excluding the country from which such excess of exports is claimed to have been made.

If the Arbitration Board shall have decided that the export quota of the country involved was exceeded, the party or parties representing such country shall pay to the Council the cost of arbitration.

Article IX.

This agreement shall continue until September 1st, 1935.

Executed at Brussels, May 9th, 1931.

Java Technical Notes.

CRYSTALLIZERS. **P. Honig and W. F. Alewijn.** *Proefstation Mededeelingen*, 1930.

In the first part of this contribution, the various types of apparatus for the forced cooling of massecuites which have appeared during the past few years are described. These comprise the Lafeuille, which is well-known[1]; and the Werkspoor, recently described.[2] In the Herisson, which has been developed in Natal, cold water is passed through a stirrer of tubes, built into the crystallizer.[3] This apparatus is here criticized on the grounds that apparently more power is necessary than for the Werkspoor, that the massecuite is not uniformly cooled throughout the whole length of the crystallizer, and that the cooling time appears to be very long compared with the Lafeuille and Werkspoor apparatus. A cooler showing some similarity to the Herisson is that patented by C. H. J. VELDKAMP and J. L. TER HALL,[4] though in its design care has been taken to ensure regular cooling throughout the whole length of the crystallizer. Another rapid cooling crystallizer is that patented by the N. V. Constructie Atelier der Vorstenlanden, of Djochakarta, Java, consisting of an entirely rotating crystallizer made of two conical halves, which are fastened together at their greater diameters. Another Dutch apparatus is that made by the N. V. de Ned. Ind. Industrie, which consists of a trough in which there are a number of stationery disc-shaped cooling bodies, in every other one of which above and below there is an opening, through which the massecuite with the help of a propelling double stirrer circulates along the cooling bodies through the crystallizer. The cooling bodies are adjustable as to height; and, according to the inventors, existing crystallizers with this apparatus can be converted into the rapid cooling type.

Quite a different construction is the device adopted in the Paauilo factory of the Hamakua Mill Co., Hawaii.[5] This factory had eight cylindrical crystallizers with a capacity each of about 200 hl. A part of the upper portion of three of them was removed during the 1929 milling season, and around the large upper opening a rim was welded on, then half-a-dozen groups of 2 in. horizontal cooling pipes were welded to the walls of each, through which water could be circulated zig-zag fashion. In this manner there was introduced into each crystallizer about 11 sq. metres of cooling surface, the stirrers being left so that they could turn between the groups of coils. The cooling time was found to be 84 hours with this device, that is 12 hours shorter than in un-cooled crystallizers, and the massecuite temperature fell to 27°, instead of 33·5°C. Lower purity molasses was not obtained, but fermentation and difficulty in centrifuging were entirely prevented. Yet another type of cooling system is that put on the market by the Främbs & Freudenberg, of Schweidnitz, Germany, using six crystallizers arranged one after the other, this method of operating being combined with the Heil boiling and cooling process.[6] Similar devices have been invented by VENDITTI[7] and by OWSIANNIKOW.[8] Strikes are dropped into the first crystallizer with a slight supersaturation, and travel the whole length of it with continuous stirring, the crystallizers being provided into parts with bulk-heads with holes in the lower edge. The heaviest crystals sink downward and are the first to be pushed by the stirrer towards the outlet opening, while the finer grain remains suspended passing on so as to grow

[1] *I.S.J.*, 1926, 279; 495. [2] *I.S.J.*, 1930, 306; 1931, 283. [3] *I.S.J.*, 1929, 514. 1929, 436, 447.
[4] Dutch Patent, 36565, Class 89.
[5] Reports of the Association of Hawaiian Sugar Technologists.
[6] *I.S.J.*, 1930, 260. [7] *Centr. Zuckerind.*, 1922, 23, 37. [8] *Ibid.*, 1926, 1928

more. In this way it is expected that after the massecuite has flowed through the five crystallizers one after the other it will have a larger average crystal than if it had been cooled in the ordinary fashion.

FACTORS AFFECTING THE ASH CONTENT OF FACTORY JUICES. **L. Wichers.** *Archief*, 1931, **39**, I, No. 18, 472-477 .

Following the interesting contribution of VAN LIGTEN on the factors influencing the ash content of factory juices, THIEME has drawn attention to some effects of cultivation on the composition of these juices.[1] In a previous report on this matter,[2] the author published some results obtained with juices of the Assembagoes and Balongbendo factories, and now to give a further insight into it, figures for another factory are cited. Table I (not reproduced in this abstract) summarizes the analytical results of the juices of the Bodjong factory, five different types of soil and three varieties of cane being here concerned. It is clearly indicated that the removal of SO_3 from the Klawing and Pekatjangan clay soils is considerably greater than from the Slamat marl soils, the latter being characterized by a low content in SO_3 and in Cl, lower even than could be observed for the other two factories. Further the Cl content of the clay soils is in general very low. In Table II analyses of juices of the Soekodono factory are presented. Two points in connexion with them deserve attention, namely the very low CaO content of practically all the samples examined, and further the very high SO_3 and Cl contents of juices coming from humus soils. Alongside the low CaO contents, very high figures for the MgO were found, higher indeed than may normally be expected. VAN LIGTEN mentions that in recent years more frequent complaints have been made of the splitting of cloths in the filter-presses, and it is remarkable that in the Soekodono factory where the juices have a very high MgO content this trouble is generally more accentuated than in other factories, in spite of much care to lessen it. There appears to be a connexion between these two circumstances.

Table III gives complete analyses of some juices of the Sempalwadak factory. Compared with the results of the juices of other factories, these show no striking differences. It may, however, be pointed out that the SO_3 and Cl contents are low in all in relation to the K_2O content, from which one may conclude that the content in organic salts in these juices is higher than in the juices of other factories. Regarding Tables IV and V, which give analyses of samples of juices from the Klampok and Poerworedjo factories, as reported by the Experiment Station, especial attention should be given to the figures of the latter with regard to the ash content of the EK 28 and POJ 2878 juices. Three parallel tests all showed that POJ 2878 takes up more mineral constituents than does EK 28. It is a general experience that the introduction of POJ 2878 variety has been accompanied by an increase in the ash content of the factory molasses. It has been noticed, moreover, that more mineral matter has been precipitated in clarification with a greater separation in evaporators and pans, the main constituent of the incrustation being $CaSO_4$. A general summary of total average figures for the juices of several factories is finally given below, expressed in grms. per litre of juice. Some further information is yet sought on the effect of clarification on the juices of varying mineral constituents. Generally juice clarification runs most smoothly at Assembagoes ; while strongly opalescent juices mostly occurred in the cases of the Bodjong and Sempalwadak factories, due perhaps to their very low Cl contents.

[1] *I.S.J.*, 1931, 131. [2] *Archief*, 1928, 26.

Factory	Ash	K_2O	CaO	MgO	SO_3	Cl
Assembagoes	7·73	3·290	0·100	0·149	1·049	0·977
Balongbendo	—	—	0·070	—	0·543	0·680
Bodjong	—	—	0·110	0·111	0·672	0·167
Poerworedjo	4·12	1·471	0·194	—	1·388	0·170
Soekodono	3·20	1·100	0·052	0·150	0·670	0·470
Sempalwadak	4·82	1·986	0·080	0·046	0·462	0·272
Soemberredjo	3·80	0·815	0·050	0·079	0·228	—
B.O. Tasnan	—	—	0·055	0·033	0·678	0·120
Klampok	4·54	1·296	—	—	—	—

CLEANING THE JUICE-SIDE OF EVAPORATORS. **W. Chr. Bedding and J. C. Friedrich.** *Archief*, 1931, **39**, I, No. 21, 563-568.

A number of preparations have been recommended for the removal of incrustation from the juice-side of evaporators, and the fact that these are effective, although applied in considerable dilution, suggests that they are worth submitting to a closer examination. Thus a preparation called "Algor," using a concentration of only 1·5 grm. per litre, has been used in one of the Java factories for boiling out the evaporators, it being found that the incrustation had been so softened that it was removable easily with brushes. Investigations conducted at the Experiment Station showed that this "Algor" solution contained 42·8 grms. of dry substance, and 18·5 grm. of ash per 100 c.c. It had a potentiometric *pH* of 10·77 (a colorimetric determination of the brown liquid being impossible), and sodium and silica were found to be present, though no further quantitative examination was made of it. Analysis of the incrustation concerned, as scraped from the first body of the evaporator, was :—

	Per Cent.		Per Cent.
Loss on drying	6·25	Total CaO	35·08
Loss on ignition	18·77	$CaSO_3$ (calculated from the SO_2)	51·24
Silica, SiO_2	4·81	Calcium as $CaSO_4$	16·88
Iron and alumina	1·27	SO_2	27·30

First, the effect was investigated of boiling 1 grm. of the incrustation in "Algor" solution containing 1·5 grm. per litre, the calcium content of the solution being determined before and after the boiling, the original calcium content of the "Algor" solution having been found to be 0·037 grm. per litre. After boiling, the filtered solution contained the following amount of CaO in grms. per litre : Coarse incrustation 0·116 ; Fine incrustation 0·156.

In another series of experiments, the effect of increasing quantities of alkali on the calcium-removing power of the "Algor" was examined : 1 grm. of incrustation being boiled with the liquids, which were afterwards filtered, and their calcium contents determined after filtering :—

"Algor," 1·5 grms, per litre	0·1632
Ditto, plus NaOH, 0·166 per cent.	0·0848
,, ,, 0·500 ,,	0·0324
,, ,, 2·500 ,,	0·0220

It is thus seen that increasing the alkali content of "Algor" lowers the calcium content of the extract considerably, due to the high degree of dissociation of this base. It may be of course that the favourable effect of "Algor" in softening evaporator incrustation at the factory concerned may not be due to its power of taking up calcium. Such a method may be compared with the well-known alkali and acid boiling-out process : Thus 1 grm. of incrustation was boiled for 7 hours with 300 c.c. of a solution containing 5 per cent. of NaOH and 5 per cent. of sodium carbonate, when the CaO content of the filtered liquid was found to be 0·002 grms. per litre ; then the residue was boiled

with 300 c.c. of 0·5 per cent. HCl for about half an hour, and filtered, when its CaO content was found to be 1·347 grms. per litre, leaving an undecomposed residue of only 1·5 per cent. of its original weight.

EXAMINATION PAPERS FOR THE QUALIFICATION OF "SUGAR CHEMIST," 1931. *Archief*, 1931, **39**, 1, No. 15, 379-383.

In the examination for those wishing to attain the qualification of "sugar chemist" as a preliminary to obtaining posts in Java factories, fifteen questions were set in Theoretical Chemistry; three in Sugar Manufacture; three in Manufacturing Control; four in Plant and Accessories; four in Legal Regulations; and four in First Aid. Following are some of the questions selected here and there from the papers, in order to show the high standard of knowledge required for students wishing to enter the Java sugar industry. *Theoretical Chemistry.*—What are sugars; how are they classified; discuss the difference between glucose and fructose? A solution of sucrose having a freezing point depression of 0·186°C. was completely inverted by the addition of 2 c.c. of HCl of 20 per cent. by weight per 100 grms. of solution; what is now the f.p.d., and what would if be if the solution had been neutralized with 0·1 *N* NaOH after the inversion (data necessary for the calculations being given)? What is the difference between the iron of potassium ferrocyanide and ferric alum? What do you understand by a titration curve? Give one each for a strong acid and a weak base, and discuss its form. What do you understand by: adsorption, coagulation, emulsoids, suspensoids, and the Tyndall effect; and what is the stabilizing factor with an emulsoid and with a suspensoid? *Sugar Manufacture.*—In which different ways can one sweeten-off a Kroog's press, and a Kelly, Sweetland, Vallez and Oliver filter? What means would you employ, and what precautions would you take, in juice purification, and in the further processes of manufacture, in order that the white or raw sugar made should keep its quality as long as possible stating also the requirements a good warehouse must fulfil? Between what *pH* limits does the acidity of the juice range at the different juice purification stations, and what approximately are the corresponding titrimetric acidities, using phenolphthalein as indicator? *Control.*—What do you consider a normal figure for the following: fibre per cent. cane; Brix per cent cane; raw juice per cent. cane; fibre per cent. bagasse of last mill; maceration water per cent, cane and per cent. fibre; Brix first expressed juice; for defecation, sulphitation, and carbonatation factories the quotient of purity of first juice, clarified juice, and of thick-juice (evaporator syrup)? *Plant and Accessories.*—A cane sugar factory, grinding 12,070 q. in 24 hours, has an evaporating plant consisting of four bodies connected in series, each 243 sq. m. heating surface, to which is sent hourly 48,200 kg. of juice at 17° Brix, there being no bleeding for pre-heating. (*a*) How much steam is necessary hourly to thicken the juice to 59°Brix? (*b*) How much steam would be saved if, after replacing the first body by a larger size, one were to practise heating of the raw and clarified juice with vapour from the first body, assuming the temperature of juice-heating to be 70°C., and the quantity of raw juice to be 48,200 kg. per hour? (*c*) What would the size of the first body be if the rate of evaporation were kept below 26 kg. of water per sq. m. of heating surface per hour? (*d*) It is desired to use one of the existing pre-heaters of 64 sq. m. of h.s. for heating raw juice from 30 to 74°C., using vapour from the 1st body at 102°C. Is this pre-heater large enough, assuming a working heat-transmission of 600 kcal. per sq. m. of h.s. per hour per degree C. of average temperature difference?

Abstracts of the International Society of Sugar Cane Technologists.

Under the scheme instituted by the I.S.S.C.T. a collection of abstracts of papers on agricultural and technical subjects is prepared monthly. A selection from these "Sugar Abstracts" has been made by us from the material last issued, and appears below :—

BEET SUGAR TECHNOLOGY.

MODERN TENDENCIES IN LIME KILNS. **E. Koppeschaar.** *Tijdschrift Vereen. Biet Suikerfab.*, 1930-31, **26**, 232-236.

The new lime kiln of the Tirlemont factory in Belgium, designed by BLOCK, is 41 metres (161 ft.) in height. The interior is perfectly cylindrical ; the gas scrubber is a horizontal tank built on the ground and is of a type requiring a minimum of wash-water. Coke and limestone are fed in automatically at the top and burnt lime is removed continuously and automatically at the bottom. The automatic feeding is accomplished by a revolving cone which is divided into sectors. In operation the kiln is so managed that the fire zone extends but a short distance above and below the middle point of the shaft ; this gives the descending charge an opportunity to become preheated by the ascending hot gases, and also affords the burned lime an opportunity to cool off somewhat by giving up a portion of its heat to the air entering from below. One consequence of this practical exchange of heat is that not more than 7 to 7½ per cent. of coke (on weight of limestone) is required. This smaller fuel requirement makes it easier to prevent excessive temperatures and thus prevent slagging.

IMPORTANCE OF PRELIMINARY PURIFICATION OF DIFFUSION JUICE.—**I. B. Minz and B. E. Krassiltchikoff.** *Naukovi Zapiski*, 1931, **9**, 515-537.

Diffusion juice is sulphured at not above 30°C. to *pH* 4·0. This is followed by neutralization with 0·5 to 0·6 per cent. of CaO on weight of juice, taking care to keep the alkalinity below 0·10 (otherwise the juice is darkened). No inversion is observable as a result of sulphuring to *pH* 4·0. After liming as above described, the juice is heated to 80°C., filtered, and carbonatated to an alkalinity of 0·01 to 0·02. The juice resulting from this process is at least not inferior to that obtained by the usual carbonatation process (2 per cent. of CaO plus double carbonatation).

AN APPROPRIATE MEANS OF UTILIZING THE WASTE HEAT OF CHIMNEY GASES. **H. Claassen.** *Cent. Zuckerind.*, 1931, **39**, *Festausgabe*, 491-492.

Both theory and practice of utilizing heat in sugar factories have been worked out so that the only remaining source of economy lies in the waste heat that goes out of the stack. The author adds the following scheme which was worked out and used in the Dormagen factory : The hottest condensate from the first stage of a pressure evaporating system (temperature 120-130°C.) is returned directly to the boilers as feed water ; the rest of the condensate, with a temperature of about 100°C., is circulated through the first juice warmers, where it gives from 20 to 30°C. of heat to the cold juice. The further heating of the juice to 85-90° is accomplished indirectly by means of the heat in the small stack gases. To accomplish this transfer there is built into the flue a heat exchanger of dimensions such that water entering at 90° will be heated to 110-120°. By this arrangement it was found possible to take out of the waste gases all heat in excess of 160-180° ; a further amount of heat can be recovered from these gases by conducting them

to the pulp dryer (which has its own independent heating plant) where they are used instead of cold air for bringing down the temperature of the furnace gases from 700°C. to the drying temperature.

CONDUCTOMETRIC DETERMINATION OF THE AFFINING QUALITY OF RAW SUGAR. **K. Sandera and C. A. Ruzica**. *Zeit. Zuckerind. Czechoslov.*, 1931, **55**, 423-431.

The authors instituted an experimental comparison between the so-called "Berlin Method" of determining the affining quality of raw sugars (mixing with a certain amount of water and centrifuging) and the electrometric method based on conductivity measurements. The two methods are comparable. The electrometric method has many possibilities of use.

CANE SUGAR TECHNOLOGY.

ARGENTINE FACTORY DATA, 1929. **W. E. Cross**. *Boletin Esta. Exper. Agr. Tucuman.* December 1930.

This is the fourth annual publication of factory data of all the cane sugar factories of the Argentine Republic, arranged in tables somewhat in the manner of the Java "Eindstaat." From the data shown it appears that the total cane area in 1929 was less than for several years previous, due to the crisis resulting from overproduction. On the other hand, the yield of cane per hectare attained record high figures in the provinces of Salta and Jujuy. The factories in these provinces also established new high records for rendement (9·69 and 9·39 per cent.), whereas in Tucuman the rendement was only 7·66 per cent., the lowest since 1929. The average production of sugar in Salta province was 7·11 tons per hectare (2·88 metric tons per acre). Numerous tables give detailed information regarding the operations at the different factories; from these tables the following maxima and minima are selected :—

	Maximum Per cent.	Minimum Per cent.
Extraction of sucrose	92·30	81·90
Milling efficiency—		
Extraction ratio	1·28	0·69
Milling loss	14·58	7·12
Sucrose loss quotient	18·02	7·63
Moisture in bagasse	52·20	45·40
Juice 1st mill—		
Brix	19·17	15·20
Sucrose	15·77	11·60
Purity	82·24	76·32
Glucose coefficient mixed juice,	17·64	4·01
Sucrose per cent. cachaza	10·95	5·59
Molasses per cent. cane	4·38	2·50
Purity of molasses	40·50	30·73
General relative efficiency	100·47	81·88

STUDIES ON PULP DRYING WITH SUPERHEATED STEAM. **M. Stuntz.** *Cent. Zuckerind.*, 1931, **39**, 356-359, 380-383, 404-406.

On theoretical grounds the author makes extensive calculations showing the advantage of drying beet pulp by means of superheated steam instead of with hot gases derived from direct firing. In the scheme outlined, the wet pulp is to be forced into a closed, horizontal, revolving drum, where it will come into contact with superheated steam under a pressure of 30 to 40 lbs. The drying drum will be well insulated; the superheated steam will become

saturated by evaporating water from the wet pulp, which is thus dried and continuously removed from the drum by a forcing screw. The saturated steam is led out of the drum through a superheater, and as much as is needed is circulated back through the drying drum; the excess is drawn off for heating purposes in the factory. The calculations show that the idea promises considerable savings in fuel costs.

STARTING UP A LIME KILN. **B. A. Blok.** *Archief*, 1930, **38**, II, 877.

According to the author one of the main causes of "hanging" lime kilns is traceable to improper handling of the kiln when it is started up at the beginning of the campaign. The procedure he advises is to select large pieces of limestone—three times the size of the fist—for the first few days' operation. The first charge of wood, coke, and limestone should not exceed two-thirds the capacity of the kiln, so that when the wood has burned out the kiln will be about half full. Feeding of the large sizes stone is continued until the kiln has become thoroughly seasoned, and thereafter it may be managed in the regular manner. The utility of starting the kiln in this way depends on the fact that the large stones assure a good uniform draft through the whole cross-section, thus avoiding local heating during the critical first period. Many of the large stones will have unburned cores, but this disadvantage is more than compensated by the absence of "hanging."

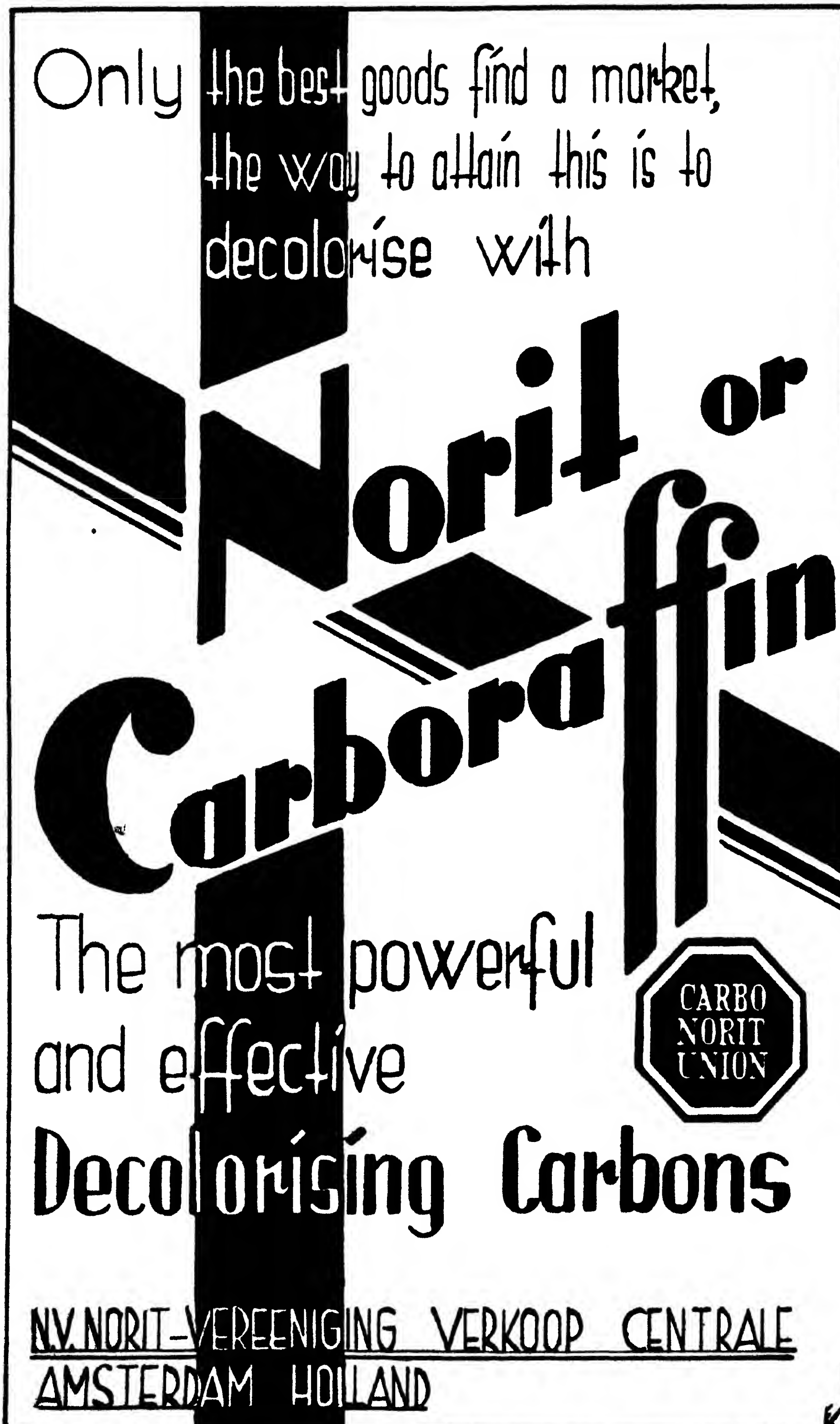
CHLORINE AS A DECOLORANT IN SUGAR ANALYSIS. **L. R. Bliss.** *Rev. Ind. Agr. Tucuman*, 1930, **20**, 180-186.

Solutions of coloured sugar products, especially molasses, are often difficult to polarize in a 200 mm. tube, even after clarification with HORNE'S dry lead. The author discusses the use of dry, gaseous chlorine as a further means of decolorizing such solutions; the gas is bubbled for several minutes through the solution, which is then treated with alumina, if necessary, to remove traces of colloidal lead, and filtered. Special tests showed that no sugar need be inverted by this method.

EXHAUSTED MOLASSES, CONSIDERED PRACTICALLY AND THEORETICALLY. **J. G. Thieme.** *Archief*, 1931, **39**, 361-375.

The theoretical exhaustibility of molasses depends on the ratio of organic to inorganic non-sugar, and since the ash content of non-sugar can vary greatly it is not possible to say how far a factory has been successful in exhausting its molasses. This may be done by an indirect calculation. As a measure or point of reference for the exhaustibility of molasses, the author sets up an arbitrary standard, "minimum purity," which is defined as the purity of a molasses of 85 per cent. dry substance content saturated at room temperature. This standard is chosen because none of the Java sugar factories has been able to reach it. The difference between the actual purity and this standard minimum purity is a measure of the success attained in exhausting the molasses. The minimum purity is determined by bringing the molasses to a purity of $100 \cdot \frac{\text{sucrose}}{\text{refr. Brix.}} = R_1$ by saturating with crystal sugar at room temperature, determining by refractometer the purity of the saturated molasses, R_2, and correcting this empirically to 85° refr. Brix.; this gives the minimum purity, R_3. The minimum purity may also be obtained approximately by calculation from the formula :— $R_3 = (\text{ash per cent. non-sugar} + 6)\frac{8}{7}$.

Any considerable discrepancy between found and calculated purity must be due to incorrect data or some abnormal circumstance. In searching for


Only the best goods find a market,
the way to attain this is to
decolorise with
Norit or
Carboraffin
The most powerful
and effective
Decolorising Carbons
CARBO
NORIT
UNION
N.V. NORIT-VEREENIGING VERKOOP CENTRALE
AMSTERDAM HOLLAND
K

the cause of a high difference $R_1 - R_3$, this number may be split into the differences $R_1 - R_2$ and $R_2 - R_3$; the number $R_1 - R_2$ appears to depend chiefly on the temperature of centrifuging, $R_2 - R_3$ on the concentration of the molasses. At a given temperature of centrifuging, t, one may expect $R_1 - R_2 = (t - \text{room temperature})\ 0{\cdot}36$. If the actual is smaller than the calculated difference—which may occur by dilution of the massecuite before centrifuging, steaming in the centrifugal, etc.—this advantage may or may not be neutralized by a great difference $R_2 - R_3$. If the actual difference $R_1 - R_2$ is much greater than the calculated difference, this may be due to fine grain in the molasses or to high supersaturation at the centrifugals (too rapid cooling, too coarse grain, etc.). The extent to which the temperature of centrifuging is due to a too small cooling equipment will appear from a comparison of this temperature with the cooling surface per 100 hectolitres of massecuite per day. Good cooling (to about 35°) can be attained with about 35 square metres cooling surface per 100 hectolitres per day. A poor cooling effect may be due to a poor vacuum in the molasses sugar pan, decompositions in the massecuite, too high a Brix, poorly managed cooling equipment, etc. Finally, too low a Brix of the molasses may result in an unfavourable difference $R_2 - R_3$; this may be due to poor centrifugability resulting from a poor quality of grain or too small a centrifugal capacity.

Wear of Crusher Rolls. **J. Eigenhuis.** *Archief*, 1931, **39**, 122-127.

When the wear on crusher rolls is measured it is found that the decrease in the height of the teeth is less than would be expected from the decrease in the over-all diameter of the roll itself. This indicates that the bottoms of the teeth are also subject to heavy wear. At the present time crusher rolls of both cast steel and cast-iron are in use, and there is much debate as to which material is the better. To obtain information on this subject the author searched the voluminous annual reports on file with the Experiment Station, in which there is a large accumulation of measurements of the wear of crusher rolls. The matter was found to be somewhat complicated by the fact that the sugar mills of Java use both cast steel and cast-iron crusher rolls with different forms of teeth. On the one hand there are Krajewski crusher rolls with short, thick teeth (height 45 mm.) and the so-called Sempalwadak rolls with long, sharp teeth (height 60 or 65 mm.), with several intermediate groups. After a statistical investigation of the reports on the wear of these various types the author finds as follows:—The teeth of Sempalwadak crusher rolls wear less at the sides than on the bottom, so that the height of the teeth decreases less than in the case of cast steel rolls; the high tooth form of crusher rolls should therefore be made of cast-iron. The reason appears to be that, on casting, the points of the teeth cool quickly and the metal is therefore harder at the points than on the slower cooling bottoms. It also appears that the wear on the teeth of two Krajewski rolls is smaller than on two Sempalwadak rolls of the same metal, due to the fact that the latter give a better crushing effect, especially at high capacities, and are thus naturally subject to greater wear.

Unfair Russian Competition.—A Conference is shortly to be held in London to inaugurate the formation of an active organization to oppose Soviet dumping. Among the various goods which are being imported into the United Kingdom at prices which bear no relation to their cost are glucose, boiled sweets, and fruit pulp. This organization is being promoted by the Joint Conference on Unfair Russian Competition, of 53-54, Haymarket, London, S.W.1., who invite membership.

Beet Factory Technical Notes.

Continuous Centrifugals.—Advantages to be gained by continuous centrifuging are obvious and indisputable, namely, less power, time, labour, space, and probably also less invested capital. In an article on this important development, G. Horsin-Déon mentions[1] that the first continuous machine was the Dumoulin which appeared about 1885, then came the Sczeniowsky and Piontrowski in 1889, and now relatively recently the Zelezniak.[2] All are based on the same principle, namely, the use of a conical basket, up the wall of which the material climbs in a thin layer under the influence of centrifugal force, more or less rapidly, according to the viscosity of the material and the rate of revolution. In the Piontrowski machine the greater diameter of the basket is 1·5 metre, and the smaller 0·5 metre, the angle of the cone being 45°. Its rate is only 470 revs., making a speed of 37 metres per second where the sugar is discharged. The area of the perforated metal is 1·5 sq. metre. An ordinary machine having a basket 1·250 metre in diam., which is charged five times in the hour, has an output of 1000 kg. of sugar in the same time. The output of the Piontrowski machine is 1800 kg. per hour, so that with a 52 per cent. sugar yield the amount of massecuite fed is 3460 kg. per hour. The sugar leaves in a layer 12-15 times thinner than in the ordinary centrifugal, which explains why the rate of 470 revs. is sufficient to purge away all the mother-syrup and leave a white sugar. The Piontrowski machine is much used in Russia, and a few are functioning in France. In 1914 one was working in the Flavy-le-Martel factory, from the ruins of which it was recovered by Mr. Tabary, who repaired it and re-erected it at Eppeville, where it is still used.

In order to increase the output of the Piontrowski machine, it would be necessary to enlarge the diameter and height of the basket, so as to increase the filtering surface. But this would mean that the circumferential speed would be increased at the point of discharge, and that the sugar would be too violently expelled on leaving. Zelezniak in his design overcomes this by using two baskets, one inside the other, so as to have a greater filtering surface, the large and small diameters of the outer one being 1·8 and 1·1 metre, and those of the inner 0·950 and 0·600 metre. Heights are 575 and 460 mm., but the angle of the cone is smaller. He thus obtains a total filtering area of 3·7 sq. m., that is 2½ times that of the Piontrowski, giving 2½ times its output, viz., 4500 kg. per hour, while still using the same speed, viz., 450-470 revs. The mother-syrup is expelled in the smaller basket, and washing with water is done at the base of the larger one, the steam-washing and drying following. This Zelezniak machine also works with very thin layers, which progressively diminish during the elimination of the mother-syrup and the washing of the sugar, thus attaining the maximum effect in the minimum time. Objections made to continuous centrifugals are that they are too mechanical and cost too much. They, however, produce more sugar per hour, five times in the case of the Zelezniak. If, therefore, the Zelezniak is to replace five machines of of 1·250 metre diam. costing 25,000 fr. each, its cost should be less than 125,000 fr., which is easily so. Less power is required. Its maintenance is lower, there being no cloth deterioration. The wash-water is admitted continuously. One man replaces five, and it is unnecessary that he should be specially selected for the work.

Iso-Electric Point.—Prof. Teatini in one of his communications has stated that " the iso-electric point of colloids in alkaline medium has not been determined " ; and that " no one has ever followed the purification of juice

[1] *Journal des Fabricants de Sucre*, 1931, No. 17.
[2] *I.S.J.*, 1931, 242, 363.

from the colloidal point of view by means of the ultra-microscope." Dr. P. J. H. VAN GINNEKEN, of Bergen-op-Zoom, Holland, now remarks that this is incorrect.[1] In 1926 in collaboration with Dr. A. H. W. AKEN, of the University of Amsterdam, and J. P. M. VAN GILSE, he studied the flocculation of the colloids of juices, and at the same time discussed fully the problem of the iso-electric point of these colloids.[2] There it was mentioned that the problem was not a simple one, first, because there are several colloids having different iso-electric points, and, secondly, because it is not in general the iso-electric points of the colloids that are determined but those of their salts. In fact there are two points of coagulation for beet juice, one close to the carbonatation point, and the other not far from the neutral point. Nor is TEATINI correct in his statement regarding the use of the ultra-microscope in the clarification of juice from the colloidal point of view. This technique has been adopted by Dr. VAN GINNEKEN for a number of years in a sugar factory laboratory. Indeed the idea of applying the ultra-microscope to such observations, and of using the iso-electric point as a basis for the elimination of the colloids (or rather of their salts), is not new and is not the property exclusively of Prof. TEATINI. To this investigator is due, however, the honour of having practically applied those scientific ideas, with which it should be possible up to a certain point to achieve success, though the extent of the actual pecuniary advantage yet remains to be seen.

New Decolorizing Process.—Under the heading of "The New MgO Process," FR. WILH. MEYER publishes[3] particulars of a new method of working thin-juice. It has as its object the "automatic re-alkalizing" of the sulphited thin-juice, and at the same time it effects a considerable decolorization over that due to the SO_2. It has been operated in a well-known German factory for the past three campaigns with great satisfaction. It is simple and economical, and is said to give a distinctly improved white sugar. Juice from the second carbonatation is sulphured so as to be acid to phenolphthalein while slightly alkaline to rosolic acid. It is then treated with the MgO, and for so doing the layer filtration method, as is used in carbon refineries, has proved best. MgO powder (50 kg.) and powdered wood charcoal (10 kg.) are mixed with water and used for pre-coating a press (the 60 kg. of mixture covering 15 sq. metres with a layer 10 mm. thick). On pumping the sulphited juice through this layer, it leaves the press with an alkalinity of 0·01-0·02 per cent. (as CaO) and with very little colour. Thick-juice which is light lemon (the red having been absorbed) is thus obtained, from which is boiled a faultless white sugar. Last campaign the cost of the process working 150,000 tons of roots was RM. 2111 for the MgO and RM. 168 for the charcoal, i.e., 0·104 pfg. per ztr. of roots, or 0·730 pfg. per ztr. of white sugar (say 15 pence or 30 cents. per ton of white sugar). It is stated that decolorization by MgO in this way costs about $\frac{1}{7}$th of what it would if "Norit" had been used, and that the spent MgO can be regenerated twice by simply washing with water in filter-presses. It is also said that the boiling of the white sugar strike could be shortened from 5 to 3 hours, other conditions equal, while curing was quicker also. Dr. O. SPENGLER, Director of the Institute of the German Sugar Industry, Berlin) in a foot-note to this article confirms the accuracy of the author's statements regarding the advantages of the process (which has been patented).

---

1 *Journal des Fabricants de Sucre*, 1931, **72**, No. 3, page 1.

2 *Recueil des Travaux chimiques des Pays-Bas*, 1926, **45**, 792.

3 *Zeitsch. Ver. deut. Zuckerind.*, 1931, **81**, No. 446, 378-390.

Alkalinity Control.—Dr. O. SPENGLER, F. TÖDT, and ST. BÖTTGER of the staff of the Institute of the German Sugar Industry, Berlin,[1] have had under investigations different methods of controlling the end-point of the first carbonatation. They have tried out experiments with four different methods. (1) LINDNER's electrical conductivity apparatus; (2) BRUCKNER's froth pressure gauge; (3) the usual titration figures; and (4) indications according to thymol-phthalein paper. During last campaign in a German factory, runs of half an hour were made with each method, during which time samples were taken every two minutes for their alkalinity determination in the laboratory. Curves were plotted showing per cent. CaO alkalinity against the time in minutes for the four methods. Of these, titration was found to exhibit the greatest variations during the 30 mins. run. The best results of all were obtained when using indicator paper. The LINDNER and BRUCKNER methods gave about the same results, their place being intermediate between the titration and the indicator methods. These results stand well in agreement with the number of valve adjustments it was found necessary to make to maintain the prescribed alkalinity during the experimental period. In the titration method 15 adjustments were made, i.e., every two min., that being about the time necessary for the operation of the titration. But with the indicator paper and the froth pressure gauge, the results were instantly available, thus allowing as many valve adjustments to be made as one liked. In LINDNER's method 30 adjustments were made in the half hour; but this apparatus could probably be improved, so as to allow of more valve adjustments, say every half min. Further investigations are necessary to get an exact idea of the value of these two devices, both of which are indicated to have distinct possibilities for first carbonatation control.

"*Silumin*" *Tanks.*—In the experimental factory of the Berlin Sugar Institute, they have had in use since 1929 a tank of "Silumin," an alloy of silica and aluminium, for storing diffusion juice and evaporator syrup. So obvious are the advantages of using non-ferrous vessels in white sugar manufacture and refining that it was decided by the Institute to look into the possibilities of this material. O. SPENGLER and J. WIGAND[2] now report laboratory experiments on the loss of weight occurring in contact with various media after 21-32 days at 30 and 80°C. In the case of distilled water at 4·5 *pH* and 30°C., there was in fact a small gain in weight after 32 days, due doubtless to some oxidation. At this temperature the losses occurring with 40 per cent. sugar solution, 1st carbonatation juice, and molasses were all slight. At 80°C., however, different results were observed, and there are the figures indicating the loss of weight in grms. per sq. m. per day at the end of 21 days: distilled water, 0·258; 40 per cent. sugar solution, 0·996; 1st carb. juice, 0·540; molasses, 4·475; N/10 sulphuric acid, 4·62; and N/10 hydrochloric acid, 17·76. The high result for the 40 per cent. sugar solutions is probably to be explained by the acidification of this liquid, its *pH* having fallen from 5 to 3·2. With the 1st carb. juice, initially at a *pH* of 9·5 there was a distinct amount of attack, but this diminished as the alkalinity fell during the experimental period. Rather striking is the high result obtained with the molasses, which is attributed mainly to the non-sugars, especially the salts, this product having remained alkaline all the time. It is concluded that in general "Silumin" is a step in the right direction; and that, notwithstanding its liability to attack by hot alkaline liquids, it can be put to use for several purposes in beet sugar factories.

1 *Zeitsch. Ver. deut. Zuckerind.*, 1931, **81**, 24-259. Also *Ibid.*, 1931, **81**, 1-12 for a preliminary paper on the same subject. 2 *Zeitsch. Ver. deut. Zuckerind.*, 9131, **81**, 260-266.

Indianapolis Meeting of the Sugar Section of the American Chemical Society.

J. K. Dale acted as Chairman of the Indianapolis, Ind., meeting of the Sugar Section of the American Chemical Society, March 30th to April 3rd, and E. W. Rice as Secretary. Following are abstracts of some of the papers presented :—

Refinability and Filtrability of Raw Sugars. C. F. Bardoff and J. H. Ball. An attempt is made to show that filtrability as measured by the Elliot method is no indication of the "refinability" of a raw sugar. The paper gives data regarding the char filtration and selective colour removal by char from a syrup which has been treated with a phosphate. It is shown that, given two raw sugars with approximately duplicate refinability figures, the subsequent char filtration will produce very different filtrates, indicating that refinability and filtrability are not necessarily related.

Clarification of Sugar by Aluminium Tannate. Yun Hao Feng and James R. Withrow. Correction for volume occupied by insoluble aluminium tannate shows that the paste aluminium tannate has no appreciable effect on the polarization of high grades of sucrose, glucose and fructose. An increase of temperature increases the polarization of the normal sucrose solution in the presence of aluminium tannate 0·30°V. per °C., just as in the absence of aluminium tannate. There is no appreciable effect on the polarization of sucrose, glucose, and fructose in using dry aluminium tannate by Horne's method. Between 2 and 3 grms. of powdered aluminium tannate (about 20 per cent. water) is required for the clarification of 26·048 grms. of raw sugars.

Determination of Dextrose and Levulose. R. E. Lothrop and R. L. Holmes. A study has been made of the effect of a number of factors governing the oxidation by alkaline iodine solutions of dextrose, levulose, and sucrose, such as time, temperature, concentration, rate of addition of reagents, etc., and a modification of the method for determining dextrose and levulose in honey based on the selective oxidation of dextrose is proposed. Under the given conditions, levulose and sucrose are oxidized only to a very limited extent. The slight oxidation of levulose apparently is due largely to the Lobry de Bruyn rearrangement, and it has been shown to be influenced by time and temperature to a considerable extent. The degree of oxidation of sucrose is small, and is not influenced by time to any extent.

Active Glucose. John M. Ort. While the small amount of active glucose present in mildly alkaline glucose solutions can react only slowly with oxygen alone, traces of iron, platinum, and mercury make the action practically instantaneous without increasing the amount of active form present. Based on these facts, and on the rates of formation and of reversal to the inactive form, curves can be constructed predicting the changes of reduction intensity and of concentration of the active reductant following additions of oxygen. Experimentally determined points check these curves, whether the oxygen be added in excess or in traces or whether catalysts are present or not.

Production of Starch from Sweet Potatoes. R. T. Balch and H. S. Paine. The sweet potato is the second largest vegetable crop grown in the United States, the Irish potato holding first position. It has been variously estimated that 10 to 30 per cent. of the sweet potato crop is graded as culls owing to the rigid requirements for market potatoes. These cull potatoes

are now wasted or inadequately utilized. The sweet potato being primarily a starch producer, the possibility of utilizing the cull and excess crop as a source of commercial starch has been investigated and is herein reported in considerable detail. A procedure has been devised for manufacturing starch whereby objectionable colour can be largely eliminated from the starch, regardless of the colour of the potato flesh. The method involves the use of SO_2 in the water used in grinding the potatoes. This treatment apparently keeps the pigments carried by the starch in a reduced form until they are extracted later in the process by a dilute NaOH solution, which is thoroughly washed from the starch before it is dried. The other operations, namely, the grinding of the potatoes, the separation of the starch from the pulp, purification of the starch by settling, and drying of the starch, are essentially the same as for white potato starch production. Photographs of laboratory and semi-commercial equipment suitable for sweet potato starch production are shown. Sweet potato starch has been produced which, for textile purposes, is equivalent to imported, high-quality white potato starch. Attention has also been given to the utilization as a stock feed of the starch factory by-products, consisting of the spent pulp, which contains a substantial percentage of starch, and the effluents, which contain valuable sugars and proteins. Further studies pertaining to starch extraction, the physical properties of sweet potato starch, the nature of the pigments present in the sweet potato, and the utilization of the by-products are being conducted.

Sugar Affairs in Italy.

The Italian sugar beet crop during the 1930-31 campaign was obtained from an area of 112,000 hectares, and yielded a total production of 3,020,922 tons of roots, or on the average 27·41 tons to the hectare, which exceeds the production of the previous campaign by 100,000 tons. The amount of sugar obtained was 369,600 tons, which with the existing stocks of 100,000 tons and importations of another 2500 tons, brought the total available amount to 472,100 metric tons.

This year the drawing up of the Brussels Agreement has had its repercussions even in Italy. Contracts for the 1931-32 campaign as made with the growers show a reduction of 4½ per cent. in the acreage sown. It is anticipated that the situation will not improve rapidly and that next year a further limitation of sowings may have to be decided on. The factories desired a bigger reduction this year, but it was not considered advisable to push matters too far lest too many growers were left without employment.

As a matter of fact, the previous campaign (1929-30) already showed a reduction of 4 per cent. as compared with 1928. But by the end of 1930 it was apparent that consumption was falling, while a crisis in the sugar-using industries complicated the situation further. The consumption of Italy and its colonies did not exceed 335,000 tons in 1930, while production reached some 375,000 tons. This left a balance of 38,000 tons which added to the remaining stocks of 1929 campaign (62,000 tons) brought the total of stocks available at the commencement of this season to the 100,000 tons above mentioned. The stocks at the end of July, 1931, are estimated at 102,496 tons.

The area under cultivation this year is fixed at 106,992 hectares, and with a normal harvest it should be possible to cover Italy's sugar requirements, calculated at 330,000 tons.

Sugar Affairs in Italy.

In the Italian sugar industry during the past year the economic situation has continued unfavourable owing to reduced consumption, the difficulty of utilizing the by-products, and the unfavourable selling prices. Conditions however were less stringent than in some other industries, thanks to the precautions of the factory administrations in building up adequate reserves in better days ; there was also a fair division of sugar refining operations amongst the concerns engaged, so that internal competition has been reduced to a minimum. Efforts have been made to extend the use of sugar by encouraging the consumption of jams, marmalades, syrups, sweets and confections, and there has been an increase in the number of firms turning out these products.

The Sugar Industry in Pernambuco, 1930.[1]

(Department of Overseas Trade Report.)

Sugar.—The sugar crop which was milled from the beginning of September, 1929, to the end of June, 1930, was subject to very low prices prevailing, these being some 60 per cent. below the average prices of the previous crop. As the economic life of the district is closely related to this product, the low prices realized have had a serious repercussion on the financial well-being of the population as a whole. From September, 1929, to June, 1930, 5,018,810 bags arrived in the city of Pernambuco, to which should be added 15,531 bags in stock from the previous crop. Of this total quantity, namely, 5,034,341 bags, 788,363 bags were exported abroad and 3,422,371 bags consumed locally or sent to other States in Brazil during the nine months, leaving, at the end of June, 1930, 823,607 bags in stock in the city of Pernambuco. It is predicted that the 1930-31 crop will be some 20 per cent. less in extent than the crop of 1929-30, one reason for this being, it is stated, that many of the sugar estates have been unable, owing to financial stringency, to cultivate the growing canes. Even in zones where growing canes have been well treated, there is a visible decrease in the quanitity of cane. Should weather conditions be propitious, some of the decrease in question may be regained. The mills most seriously hit by the present depression of prices will probably commence cane cutting at the beginning of September in order to obtain ready money as soon as possible. The working of the Co-operativa Assucareira de Pernambuco, S.A., having valorization as its aim, is not apparently thought to have helped the present unsatisfactory state of the industry to any appreciable extent. It is stated that without co-operation on the part of other sugar producing centres in Brazil, such as Maceió, Sergipe, Bahia, Campos and Sao Paulo, the best intentions of the Co-operativa are unavailing in rendering relief to the present depressed condition of the sugar market here. The prospect of prices for the 1930-31 crop is not in sight at the time of reporting. In May, 1930, there was the likelihood of prices hardening as the result of a rumoured arrangement between producers in Java and Cuba to raise prices, and the local market reacted a little, only to become weaker again later on.

Sugar produced in the district is not a great factor in the world's sugar market and for some years it has been the practice of producers to export overseas only such quantities as would relieve the local surplus, often at a loss to producers who have depended for profit, to a great extent, on shipments, principally to Rio de Janeiro and Sao Paulo. Notwithstanding the smaller crop anticipated for 1930-31, it is likely that a considerable proportion of sugar of the " Demerera " type will be shipped abroad. It is possible that the increasing use of alcohol and alcohol mixtures in motor vehicles may afford a certain relief to owners of sugar mills adversely affected by the low price of sugar. There are seventy sugar mills in operation in the State of Pernambuco.

1 From " Economic Conditions in Brazil" December, 1930. Consular Report on Pernambuco Region. H.M. Stationery Office, London. 3s. 6d. net.

Brevities.

Java Crop Estimate.—On July 1st the V.I.S.P. estimated the current Java crop at 2,970,530 metric tons *tel quel*, equivalent to 2,923,750 long tons; calculated as raws this is 3,125,000 long tons, and on the head sugar basis 2,915,000 long tons.

New Company.—The Artificial Lime Co. Ltd., has been formed for the purpose of acquiring all the shares of the Société Italienne Calce Idraulica Artificiale S.A. to manufacture lime out of beet refuse (carbonatation scums). Nominal capital, £1000. E. de Arraga Vidal, Managing Director.

"Norit."—In a recently published note on vegetable carbon in the refinery by A. S. Reisser,[1] it was stated that Norit has been used in a Russian refinery, and found to have a cost of application higher than that of char. But we are now asked by the Norit Co. to say that the material used was not their well-known brand, but a carbon of Russian origin, incorrectly called Norit.

Destruction of Surplus Coffee.—In view of the suggestions made some time ago to dispose of excess sugar by dumping it in the sea, it is interesting to note that this drastic and debateable method of disposing of unsaleable stocks has been resorted to in the case of Brazilian coffee, the National Sugar Council of that country having dumped 300 tons of coffee into the sea.

Corrosion of Tin Cans.—A recent report of the Food Investigation Board states[2] *inter alia* that work has been started on the somewhat complex problem of the inhibition and acceleration of corrosion. Generally speaking, beet sugars appear to inhibit corrosion to a certain extent, whereas commercial grades of cane sugar appear to act as accelerators. The substance present in beet sugar responsible for the inhibition has not been identified.

pH of Beet Soils.—M. Joret, Director of the Station agronomique of Amiens, writes[3] that in beet cultivation he has found the optimum *pH* for his clay soils to be 7·2 to 7·5 under his experimental conditions. In fact the beet is very sensitive to the soil reaction, and a lowering of the *pH* to 6·6 to 6·8 caused the yield to fall by about 16·20 per cent. This depressive effect was greater on the control plots without nitrogen, and was to some extent corrected by nitrate of lime.

Java Assortments.—Examination of recent Java returns[4] shows that the proportion of "superior head sugar" of 25 D.S. (plantation white) has gradually increased all the time, having been 54·29 per cent. in 1921, 60·50 per cent. in 1926, and 69·81 in 1930. Next to this comes head sugar of D.S. 15 and upwards, which in 1921 was 27·89, in 1926 was 16·98, and in 1930 was 26·72 per cent. It is the Muscovados of D.S. 12 to 14 that have gradually diminished, the figures for 1921, 1926, and 1930 having been 14·97, 19·13 and 0·10 per cent. The molasses sugar made in those three years was 1·44, 2·67 and 1·83 per cent., the proportions of the other assortments being unimportant.

Technologists on Boards of Companies.—An article by Prof. Andrade in a weekly review commented on the striking absence of scientists or technologists on the boards of many of the British technical companies, as contrasted with the types usually found—political lawyers, titled nonentities, so-called "business men," etc. Dr. Francis Maxwell adds to the indictment by mentioning that in Holland a great many of the directors on the boards of sugar companies are either agriculturists, chemists, or engineers who have taken University degrees in their special subjects, and have themselves held appointments in factories or on the estates in Java, starting from the very bottom. No wonder the Dutch are the only people who can produce sugar without financial loss these abnormal times.[5]

1 *I.S.J.*, 1931, 301.
2 "The Corrosion of the Tin Plate Container by Food Products." By T. N. Morris, M.A., and J. M. Bryan, B.Sc., Department of Scientific and Industrial Research: Food Investigation Report No. 40. (H.M. Stationery Office, London). Price: 1s. 6d.
3 *Journal des Fabricants de Sucre*, 1931, 72, No. 8.
4 *Archief*, deel III, Mededeelingen, 1931, No. 3.
5 *Week-end Review*, 71, p. 75.

Java 1930 Crop.[1]—Cane harvested, 256,976,811 quintals or 1294 q. per ha.; total sugar production, in crystal, 29,158,660 q. or 147 q. per ha.; and rendement, 11·36 per cent.

Ruth's Accumulator.—The Franklin Institute, after having investigated Ruths Steam Accumulator, and " in consideration of the excellence of design of the control, equipment and the adaptation of sound principles to the successful production of large steam storage apparatus," has awarded its Wetherill Medal to Dr. Johannes Ruths, of Djorsholm, Sweden, its inventor.

Continuous Centrifugal.—The Zelezniak continuous centrifugal machine[2] is operating in a Continental beet factory, where its working may be investigated, the following being claims made regarding it : One machine replaces five of the Weston type ; it gives homogeneous sugar with syrups of variable composition ; saves labour, power, lubricants and space ; and is simple and robust, flexible and efficient in operation.

Ageing Spirits.—A recently published patent[3] for a process for ageing fermented liquids specifies contact with previously ozonized porous bodies or carriers. Thus oak chips or shavings in wicker baskets are treated with ozonized air, and put into the fermented liquid, or the liquid is circulated over them. This process is stated to be successful in the case of all spirituous liquids, and to age such in weeks whereas ordinarily years would be required.

Refining in Hawaii.—In a Report made to the Hawaiian Sugar Planters' Association entitled " Reducing Production Costs," J. Scott B. Pratt, Jr., recommends that more research be given to the problem of refining sugar in Hawaii, " there being strong reasons to believe that it would be profitable for some places to produce refined sugar, inasmuch as we are vitally interested in the costs of production until our product reaches the consumer."

Philippine Technologists.—The Philippine Association of Sugar Technologists has been formed with Mr. Carlos L. Locsin as President and Mr. Addison Kinney, Manapla Central, Occ. Negros, as Secretary-Treasurer. This organization is in line with the movement in other countries as Cuba, Porto Rico, South Africa, Mauritius, India and Queensland to have a technical association independent of sugar producers' and cane growers' associations, whose activities are confined to technical matters only.

Beet Varieties.—Investigations with stocks of beet conducted at the Norfolk Agricultural Station, Sprowston, by S. F. Armstrong[4] lead to the nett conclusion that for general purposes in England over a very wide area Kleinwanzleben-*E* is likely to give the greatest yield of sugar per acre and also to provide the farmer with the highest nett cash return. Owing to the size of its top it also possesses an added value, especially for feeding purposes, over other strains, and it does not bolt badly. Marsters and Kuhn-*P*, both of which are small topped and non-bolting strains, may be recommended for growing on rich black land or deep silts.

Sugar Utilization.—Georges Ray[5] in an article on " Possible Remedies for the Sugar Beet Crisis " recommends a number of means of utilizing sugar and the sugar beet, including restriction of the cultivation area, propaganda to develop the use of sugar, obligatory addition to bread, incomplete extraction, utilization for alcohol, etc. An addition of 2 per cent. to white bread would not sensibly affect its flavour, and the cost of this would be very low or even negligible, if such baking sugar were freed from taxes and duties. In France this amount would account for 146,000 tons per annum, an increased consumption of 8 lbs. per head per annum. Incomplete extraction in the factory, so as to return a richer pulp to the farm, would distinctly contribute towards relieving the situation, and would have an economic benefit. It could be applied without State intervention merely by agreement between growers and manufacturers without the installation of any special plant.

[1] *Archief*, deel III, Mededeelingen, 1931, No. 3.
[2] *I.S.J.*, 1931, 242, 363. [3] U.K.P., 340,647. R. Coffre.
[4] *Journal of the National Institute of Agricultural Botany*, 2, No. 4.
[5] *International Review of Agriculture*, 21, No. 10, 386-390.

Review of Current Technical Literature.[1]

Difficult Juice Clarification, and the Value of the Addition of Phosphate. **H. D. Lanier.** *Proceedings of the Fourth Annual Conference of the Association of Sugar Technologists of Cuba,* 1930.

Recently considerable attention has been paid to the phosphate content of the cane juice in relation to its clarification by the addition of lime. It is now known that proper defecation is a function of the phosphate content of the juice; and sufficient must be present to ensure a flocculent precipitate of tricalcium phosphate large enough to remove the coarse dispersoids. In part of the Santa Clara province, Cuba, the juice was found to be low in phosphates, about 50 tests showing from 0·018 to 0·027 per cent. with an average of 0·022 per cent., whereas elsewhere it has been found that the amount should not fall below 0·030 to 0·035 per cent. of P_2O_5 per 100 ml. of juice. In the Pinar del Rio district about the same P_2O_5 content was found; but, though the purity, ash and glucose contents of the two juices were almost the same, there was a great difference in the workability of the two juices. The Pinar juice always gave a brilliantly clear light-coloured juice with easy filtering muds; but the S.C. had a tendency to be turbid without sparkle and with slow mud filtration. Then the third massecuites of the latter factory gave difficulty in drying and required considerably more care to reduce its final molasses purity. Both juices showed response to treatment with phosphate, especially the S.C., but it still gave difficulty in its later working. Certainly, therefore, the phosphate content of a juice is not entirely responsible for good or bad clarification. It appears to be a matter to an extent of its initial colloid content.

However, the improvement in the general work at a particular factory by the use of phosphoric acid in defecation was so evident that it shows definitely what can be accomplished by its use under certain conditions. The average P_2O_5 content was 0·022 grms. per 100 ml. of juice. The clarified juice obtained from this juice by defecation without the addition of phosphate always lacked sparkle, the mud was slow filtering, and the massecuites viscous and slow drying. In spite of this, the factory was operating up to its rated capacity. During the past two seasons phosphate was added to the raw juice before liming at the rate of ¼ to ½ lb. 50 per cent. soluble phosphate per ton of cane ground, liming to a *pH* of 7·5, and naturally more lime was used when adding the phosphate to the juice. Up to 0·04 grm. P_2O_5 brilliant juices were obtained with no slowing up of decantation; beyond that no improvement was noted in the clarity of the juice nor in its general characteristics, but the settlings became more voluminous and the speed of the defecation slowed down considerably. The maximum increase in Kopke clarity of the clarified juice was obtained at 0·033 grms. per 100 ml. of juice and the attempt was made to maintain the raw juice before liming at this content. The rate of filtration of the mud was increased so that the filter-press station has never been crowded. The evaporation rate of the factory increased over previous seasons and the third sugar centrifugals (another station which had previously been crowded) was able to stand an increased grinding rate. The factory capacity had been increased by at least 10 per cent., it was estimated. The sucrose losses in molasses and the undetermined have been lowered and the retention increased.

Milling in Hawaii. **W. R. McAllep.** *Report of Committee on Factory Practice, Hawaiian Sugar Planters' Association,* 1930.

Developments in milling practice in Hawaii during the past decade have been much less important than in the period previous to 1920, improvements in mechanical details having been mainly concerned. In 1920 the extraction was 97·45 and in 1929 it was 97·35, while the milling loss for the two years was 2·75 and 2·72; that is results which are practically the same. This was in spite of adverse factors, as a large increase in the grinding rate, a much lower maceration, a considerable decrease in the cane polarization, and a lower juice purity. Thus the tons of cane ground per hour increased 30 per cent. during 1920 to 1929; the 33·26 per cent. of maceration applied in 1929 represents a reduction of approximately 18 per cent. in comparison with 1920;

and the average cane polarization of 13·26 in 1920 fell to 12·90 in 1929. It is of interest to enquire why, in spite of these contrary circumstances, results in 1929 were practically the same as in the first year of this decade. Firstly, a liberal capacity in milling machinery at the beginning of the decade had been provided, equipped with liberal capacity to permit moderate increases in grinding rate without interfering with the quality of the work. Secondly, more attention had been given with larger crops to regulating cane deliveries, so that periods of slow grinding on account of limited cane supply were considererably decreased, thus increasing the average tonnage per hour with increasing the actual duty demanded of equipment. Thirdly, there was a heavier pressure applied to the feed, probably the most important factor. There was a material increase in the average tons pressure per foot of roller, and this was so effectively, less of the pressure being absorbed in the housings, and more being actually applied to the cane with the widespread use of various practices having as their object the application of definite force, rather than use merely as a safety device.

Hydraulic jacks, for example, were off-set to balance the forces in the mill, and permit the top brass to run more freely in the guides. Adjustable top caps were developed to accomplish this when the required off-set could not be secured with the jacks in the old position under the mill. The size of the jacks on the gear side was increased to balance pinion thrust; discharge rollers were set tight iron to iron ; shims were removed from between the halves of the top brasses and precautions were taken to insure ample clearance between the halves. Fourthly, there is reason to believe that more effective maceration is a factor, coarser grooving in combination with heavier pressures resulting in better disintegration and cell rupture, allowing the better use of water. Fifthly, better supervision was practised, this resulting in better mechanical conditions at the mill and steadier operation. Lastly, one must not omit the considerable advances that have been made in mill sanitation. In a number of instances the newer form of self-cleaning juice pans has been installed ; and juice-pans, gutters, cush-cush elevators, etc., have been lined with copper. Juice screens have been so modified that they can be kept in sanitary condition, and unstrained juice pumps render juice-screens unnecessary except for mixed juice. One may consider briefly the direction in which milling practice in Hawaii may develop assuming that no revolutionary invention appears. It will be necessary to depend principally on further increases in effective pressure, and increases in both the quantity and efficiency of maceration, if technical results are to be maintained with higher capacities and perhaps lower polarizing cane. Mills can be made to feed against at least 80 tons per foot of roller, whereas the Hawaiian average is 70·4 tons so that there is a considerable margin here for increases. Then there is a possibility of benefiting by extending the practice of installing rollers similar to 3-roller crusher rollers in first mills, assuming that the equipment is strong enough to carry heavy pressure and sufficient power is available. Again, increasing the maceration up to 40 per cent. will be of material assistance.

Economy in Evaporation and Heating. **Walter E. Smith.** *Report of Committee on Factory Practice, Hawaiian Sugar Planters' Association,* 1930.

A recent development in the design of heat-transfer apparatus that has greatly increased the capacity of the heating surface is the use of baffles on the steam side. In this way the velocity of the steam as it passes the tubes is kept up to the most effective rate of flow, sweeping before it the non-condensible gases which may then be effectively discharged from the end of the steam passage. In the case of juice-heaters, the effect has been so marked as to make it possible to reduce the standard requirement to 20 sq. ft. of h.s. per ton of cane per hour, as compared to 35 sq. ft. without these baffles. Similar increases are claimed for evaporators so equipped, and rates of 12 lbs. per sq. ft. of h.s. have been claimed. Similarly, vacuum pans with baffled calandrias are coming into use ; but here in most cases the greater effectiveness of the h.s. is reflected in the ability to boil with lower steam pressures rather than in high rates of evaporating. Another successful development in vacuum pan design is the use of flat steam tube sheet calandrias of welded construction throughout, thus avoiding leaks at the rivetted joints between the centre wall casting and the inclined

tube sheets. In these pans the tube sheets are of copper bearing steel $\frac{7}{8}$ in. thick, the centre well projecting below the bottom tube sheet to promote circulation in the cone of the pan bottom. No difficulty is experienced in bringing the massecuite up to any density desired, and stiff massecuites discharge freely without hanging upon the top tube sheet; and besides there is a material saving in first cost to recommend it.

Probably the system of vapour utilization at Honolulu Plantation as used for the past two years is the most complete of any in the cane sugar world. There a pre-evaporator furnishes vapour for the heating of raw juice and the re-heating of clarified juice. Then a second pre-evaporator furnishes vapour for the pan floor, and the entire boiling of low grades, raw sugar, and refined sugar is done with low pressure vapour. The vacuum equipment consists of four pans each with flat tube sheets and baffled calandrias with 1·9 sq. ft. of h.s. for each cub. foot of pan volume. These pans operate with a maximum pressure of about 4 lbs. Since the factory converts its entire crop into refined white sugar, the consumption of steam at the pans is practically double that of the raw sugar factory, and the saving in steam with this system is reflected in a material reduction of the extra fuel which was formerly necessary. At Hutchinson Plantation this year, raw juice will be heated in a primary heater with vapours from the 2nd cell, bringing up the juice temperature to about 185°F.; this juice will then pass through a 2nd heater, where it will be brought up to the boiling temperature by vapours from the 1st cell. To provide for the extra duty, the 1st cell will have a h.s. of 4000 sq. ft., and the tubes will be 8 ft. long; the 2nd cell will have a h.s. of 3500 s.q ft. with the tubes 7 ft. long; while the 3rd and 4th cells will each have 2500 sq. ft. of h.s. with tubes 5 ft. long. An interesting development is found in the multi-jet condenser, designed to operate without a vacuum pump the non-condensible gases being entrained with the water, and carried down the condenser water-leg. Recent improvements in design have reduced the water consumption of these condensers to the point where they equal the work of barometric condensers with vacuum pumps. In this design the injection water must be delivered to the nozzles of the condenser at a pressure of 3-4 lbs., so that the power consumption of the water pump is practically equal to the combined requirements of both water and vacuum pump with the barometric condenser.

REPORT ON POLARISCOPIC METHODS: (1) EFFECT OF HCl ON DEXTROSE AND LEVULOSE; (2) EFFECT OF BASIC LEAD ACETATE CLARIFICATION ON THE INVERTASE METHOD. **F. W. Zerban.** *Journal of the A. O. A. C.*, 1931, **14**, No. 2, 172-181.

(1) It has been observed[1] that while the invertase method of determining sucrose indicated zero sucrose in the case of pure invert sugar, small percentages of apparent negative sucrose were indicated in the analysis of its mixtures with asparagin and aspartic acid. Similarly, the JACKSON and GILLIS Method No. II gave slightly negative sucrose figures both with invert sugar itself and in the simultaneous presence of amino compounds. To explain these results a series of polarizations at different temperatures of dextrose and levulose; (*a*) alone; (*b*) with a solution of asparagin neutralized with sodium hydroxide; (*c*) with a solution of aspartic acid neutralized with sodium hydroxide; (*d*) with HCl; (*e*) as (*d*), but with addition of asparagin solution as under (*b*); and (*f*) as (*d*), but with addition of aspartic acid solution as under (*c*). The nett result was that at about 30°C. levulose is slightly attacked by HCl in absence of amino-compounds, and by amino-compounds in the absence of HCl but not when both are present simultaneously. Dextrose is much more stable. Hence the apparent negative sucrose observed cannot be explained by the interaction of the constituents. It appears that the explanation of the Referee for 1928 is the correct one, namely, the difference in *pH* between the direct and the invert solutions, due to the acetic acid in the latter. With invert sugar alone the effect of the acetic acid in the rotation is negligible, but in the presence of asparagin or aspartic acid a difference of *pH* produces a pronounced effect, as is known.[2] Regarding the JACKSON and GILLIS method, however, the negative result is to be sought partly in the

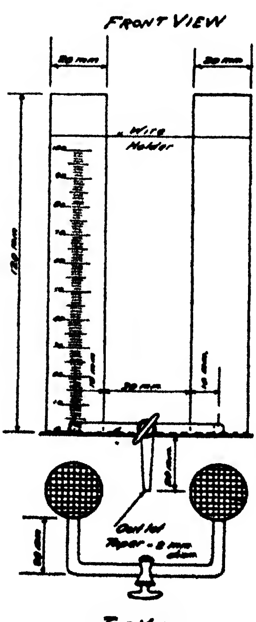
[1] *Jl. A. O. A. C.*, 1930, **13**, 188. [2] *Comptes rendus*, 1925, **180**, 1917.

execution of the method itself, namely to the raising of the temperature during the addition of the ammonia (which should be avoided by slow addition with artificial cooling if necessary); and partly to the slight destructive effect of HCl on the levulose during a period of 24 hours at 26-27°C.

(2) This second part of the Report is concerned with the effect of basic lead acetate on clarification in the invertase method. Using refinery barrel syrup (a $\frac{1}{2}$-normal weight of which could be read directly in a 100 mm. tube) readings were obtained for : (*a*) the direct polarization without deleading, using varying amounts of basic lead acetate solution from insufficiency to excess; (*b*) the direct reading, after de-leading, using ammonium di-hydrogen phosphate solution; and (*c*) the invert polarization of the de-leaded solution, using invertase. In some cases the readings obtained in the two laboratories in which they were made check closely, while in others there are rather large discrepancies, the one series of tests being carried out immediately after the receipt of the sample, and the other some months later, during which interval the composition of the syrup may have changed. No definite conclusions are drawn from these experiments, therefore, though they would appear to indicate that even a large excess of basic lead acetate does not materially affect the sucrose results obtained for refinery syrups by inversion with invertase, provided the excess lead is removed from the solution before the direct and invert readings are taken. If these results should be confirmed by further work, it is evident that the volume error caused by the precipitate must be compensated by some other error. It is pointed out, however, that entirely different results may be obtained with syrups and molasses produced in the raw sugar factory.

Modification of the Kopke Turbidimeter. **P. Herrera Cordero.** *Sugar News* 1931, 12, No. 4. 225-226.

A satisfactory method for factory work for the determination of the turbidity to show the efficiency of liming and decantation and other methods is much to be desired. Kopke's turbidimeter and devices on the same principle are subject to error, as two samples may have the same turbidity, but a darker solution will give a higher turbidity value than a lighter one; and likewise two liquids may have the same weight of suspension, but that in which the suspended matter is more finely divided will appear more turbid than that in which the particles are larger. Of course, the best method theoretically would be to separate the suspended solids by filtration, and to weigh the dry matter obtained; but practically this would be tedious and unsuitable for routine practice. So for lack of a better method, most factories still continue to use the Kopke apparatus. A modification of this turbidimeter is now described, which is claimed to be more readily manipulated and rather more accurate than the original device. It in short comprises two glass cylinders connected by a glass tube fitted with a three-way stop-cock at the middle. Both cylinders are calibrated according to their height from the bottom in millimetres, and the bottoms of both consist of squared plates as in the Kopke turbidimeter. The apparatus is enclosed in a wooden case, and illuminated with a lamp in a suitable position. In using it, the operator pours his solution into one of the cylinders, opens the stop-cock to let his solution flow into the other tube down which he looks until the lines of the squared bottom are no longer visible. Then he closes the stop-cock, and reads the turbidity value directly from the graduation.



United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

	One Month ending June 30th.		Six Months ending June 30th.	
Unrefined Sugars.	1930. Tons.	1931. Tons.	1930. Tons.	1931. Tons.
Poland	9,318	10,045	25,254	72,810
Germany	11,585	17,104	35,118	76,659
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	....	500	508	562
Java	....	....	2	....
Philippine Islands	....	....	....	....
Cuba	93,490	111,545	276,506	212,705
Dutch Guiana	....	....	....	....
Hayti and San Domingo	21,366	23,656	141,522	84,834
Mexico	....	....	....	....
Peru	3,503	5,541	42,463	61,701
Brazil	3,855	....	40,304	1
Union of South Africa	726	....	15,404	35,121
Mauritius	740	1,450	79,447	117,829
Australia	1	....	69,867	80,804
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	17,075	5,591	53,346	52,083
Other Countries	3,532	4,142	27,844	57,419
Total Raw Sugars	**165,191**	**179,574**	**807,585**	**852,529**
Refined Sugars.				
Poland	....	....	....	329
Germany	129	90	543	527
Netherlands	961	1,214	5,204	4,135
Belgium	117	171	442	765
France	....	....	....	....
Czecho-Slovakia	4,841	3,540	15,837	17,304
Java	....	....	....	....
United States of America	1,275	659	5,488	4,374
Canada	1	....	1	3
Other Countries	1	6	18	23
Total Refined Sugars	**7,325**	**5,681**	**27,534**	**27,460**
Molasses { Foreign	13,057	19,900	143,867	71,618
Molasses { British	4,145	7,865	12,953	24,189
Total Imports	**189,718**	**213,020**	**991.939**	**975,796**

EXPORTS.

British Refined Sugars.	Tons.	Tons.	Tons.	Tons.
Denmark	52	79	307	282
Netherlands	....	..	....	....
Irish Free State	3,629	4,067	21,213	19,689
Channel Islands	40	55	924	667
British West Africa	121	286	957	963
Canada	....	....	....	....
Other Countries	8,904	2,188	79,863	29,369
	12,747	6,677	103,264	50,970
Foreign & Colonial Sugars.				
Refined and Candy	309	240	1,309	1,113
Unrefined	44	27	330	247
Various Mixed in Bond	....	....	....	....
Molasses	65	10	558	68
Total Exports	**13,165**	**6,954**	**105,461**	**52,398**

United States Atlantic Ports.

(Willett & Gray).

(Total of 2,240 lbs.)	1931 Tons.	1930 Tons.
Total Receipts, Jan. 1st to July 25th	1,440,066	1,482,042
Deliveries „ „ „	1,457,795	1,762,151
Meltings by Refiners „ „	1,454,321	1,743,420
Exports of Refined „ „	25,000	25,500
Importers' Stocks, July 25th	141,163	157,162
Total Stocks, „	230,413	335,487
	1930	1929
Total Consumption for twelve months	5,599,377	5,810,980

Cuba.

RECEIPTS, EXPORTS AND STOCK AT JULY 25TH.

(Willett & Gray).

	1931 Tons.	1930 Tons.
Production to date	3,122,186	4,671,260
Less Cuban Consumption to date	83,000	70,000
	3,039,186	4,601,260
Stock at Shipping Ports	845,248	1,467,457
Total Exports	727,424	1,489,378
Total Receipts at Shipping Ports	1,572,672	2,956,835
Stock on Plantations and in transit to Ports	1,466,328	1,644,425
Total Sugar in Cuba (partly estimated)	3,044,510	3,111,882

United Kingdom.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION OF FOREIGN SUGAR FOR SIX MONTHS ENDING JUNE 30TH, 1929, 1930, AND 1931.

	IMPORTS. 1929. Tons.	1930. Tons.	1931. Tons.		EXPORTS (Foreign). 1929. Tons.	1930. Tons.	1931. Tons.
Refined	28,564	27,534	27,460	Refined	825	1,309	1,118
Raw	1,012,430	807,585	852,529	Raw	432	330	247
Molasses	134,821	156,820	95,807	Molasses	5,492	558	68
	1,175,815	991,939	975,796		6,749	2,197	1,428

HOME CONSUMPTION OF IMPORTED SUGAR.

	1929. Tons.	1930. Tons.	1931. Tons.
Refined	28,818	26,079	27,952
*Refined (in Bond) in the United Kingdom	360	707	10
†Raw	995,940	925,523	898,849
Total of Sugar	1,025,118	952,309	926,811
Molasses	5,096	3,958	2,931
Molasses, manufactured (in Bond) in the United Kingdom	1	6	—
	1,030,215	956,273	929,742

STOCKS IN BOND IN THE CUSTOMS WAREHOUSES OR ENTERED TO BE WAREHOUSED AT JUNE 30TH.

	1929. Tons.	1930. Tons.	1931. Tons.
Manufactured from Home Grown Beet	15,350	15,500	19,450
Refined in Bond	8,350	1,400	200
Foreign Refined	10,400	8,500	3,850
„ Unrefined	184,800	220,450	224,700
	218,900	245,850	248,200

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty-paid sugar returned to refineries to be again refined. Sugar refineries ceased working in Bond as from 25th April, 1928.

† The quantities here shown include 165,005 tons entered for refining in refineries in the month ended 30th June, 1931, and 841,663 tons in the six months ended 30th June, 1931.

United Kingdom Monthly Sugar Report.

Our last report was dated 10th July, 1931.

During the past month markets have been adversely affected by the influence of the German financial crisis, which caused a wave of apprehension and a general unsettled feeling pending some more definite news as to the ultimate outcome of conditions in central Europe, and the hope of some international adjustment of the position.

Towards the end of the month however, efforts towards the solution of the monetary difficulties have somewhat tended to inspire a little more confidence, but the political and financial aspects still continue to present the most disturbing features in the market.

Apart from the foregoing factors, the underlying tone of the sugar market remains steady, and actual sugar is sparingly offered. Producers strengthened under the protection of the Chadbourne plan seem unwilling to sell at prevailing prices.

The London Terminal Market shows a fall of about 3d. per cwt. over the month, the latest prices being, August 6s. 2¼d., December 6s. 6¼d., March 6s. 9¼d., May 6s. 11¼d. About 10,000 tons of Java 96° in store in Liverpool and London were tendered on August 1st.

Trading in Refined has been disappointing, although withdrawals against old contracts continue on a satisfactory scale. The British Refiners made a reduction of 3d. per cwt. on July 16th, their prices now being No. 1 Cubes 24s., London Granulated 20s. 4½d.

The American market has shown a slight improvement in price over the month, 1·50 c. and f. being paid for Cuban 96° and 3·52 for prompt, duty free.

The total sales of the V.I.S.P. of the 1931 crop now amounts to 235,492 tons.

F. O. Licht reports weather conditions favourable for the growing European beet crop, although some complaints are made from Austria and Jugo-Slavia, his previous area estimate remaining unaltered.

21, Mincing Lane,
London, E.C.3.,
10th August, 1931.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 393. SEPTEMBER, 1931. Vol. XXXIII.

Notes and Comments.

The Political Crisis in the United Kingdom.

When Parliament rose for the summer vacation in the first week of August, few dreamt that a political crisis would be staged before the month was out. Unfortunately the financial crisis in Germany had repercussions in this country that exceeded the expectations of all save perhaps the banking experts. England, as the chief banking centre of the world, is in the awkward position of being a lender of money on long terms and also a borrower of monies on short ones. So long as our credit remained good, this did not matter ; but unfortunately our internal fiscal troubles could not remain hidden from the world, and the latter came to the conclusion that we were spending in "doles" and other social outlets more than we were earning, that we were, in short, not balancing out Budget but were drawing from capital vast sums that had no chance of being repaid. Hence the creditors of the short loans started to withdraw their money, and the Bank of England soon found itself in a tight place and had to arrange hasty credits with the U.S.A. and France to preserve for the time being the position of the pound sterling. Our Labour Government was warned of the danger of a flight from the £ if international confidence was not immediately restored. A recent Royal Commission on Economy had just indicated that a retrenchment of at least £120,000,000 was the minimum to balance our Budget. The Government mapped out a scheme of economies that would have covered most of this, but when they tried to spread the burden amongst all classes they found the trades union interests violently opposed to a cut in the dole of 10 per cent., and these interests proved too strong for Mr. MacDonald since too many members of his Cabinet were under Trades Union control. The crisis threatened was a matter of hours when Mr. MacDonald decided to resign and with it went his Labour Government. He was, however, persuaded by the King to try and form a National Government in co-operation with the Conservative and Liberal Leaders and such Labour ministers as would go with him. Of the latter only Mr. Snowden, Mr. J. H. Thomas and a few others would consent to detach themselves from the official Labour Party—in other words, to put the Nation before Party. As the world knows, the last days of August saw the formation of a National Government pledged to balance the Budget by economies and extra taxation, and while we go to press Parliament is called

together to put these into effect and so restore the national credit. Till we know the precise measures to be adopted, it would be futile to speculate on the consequences, or to hazard how long this Government of statesmen who differ so strongly on the question of free trade versus protection will be able to carry on unruffled or without fatal dissensions. But everyone not blinded by prejudice will wish them well in their necessarily invidious task.

The Sugar Market Outlook.

If there has been no improvement in the sugar market during the past month, it is at least satisfactory to record that there has been no marked depression such as has visited markets in other world commodities. For this we have to thank the Chadbourne agreement which is gradually tightening up the screws and driving in the wedges of a restriction scheme destined to dispose before long of the world's excess production. It is not difficult to visualize the position of sugar in the present world depression if there were no segregated sugar and no promise of a general cut—here, there, and everywhere almost—in sugar crops. Prices would have sagged to a degree that would have found few parallels in other industries, unless in the wheat market. As it is, the market position now is actually better than it was in the first half of the year when Philippine sugars were being freely sold on the New York sugar market. In spite of her political troubles, Cuba has remained firm as a seller and in the opinion of some observers is reaping the benefit of better prices than she could have expected if the Chadbourne agreement—so much criticised in Cuba—did not run.

Two recent bearish factors have been the fresh revolution in Cuba and the misleading accounts in the press of the decision of Java to dispose of the whole of her segregated 1930 stocks of sugar. The Cuban outbreak has certainly been the most serious with which President Machado has had to contend. But by the end of August the disturbances had quieted down and it was generally accepted that the rebellion was at an end. Occurring in the off-season, it did not affect the sugar crop. But it was feared that success for the rebels would result in the tearing up of the Chadbourne treaty. However, if one German authority is to be believed, the leaders of the recent revolution let it be known that if they were successful they would stick to the international convention. This if true disposes of the fear that Cuba will not "see it through." As for Java, all that appears to have occurred is that the V.J.P. have got apprehensive of deterioration setting in in respect to their old 1930 white sugars and so disposed of the whole balance of 255,000 tons. But this will not prevent the segregated quota being maintained by supplies from the new crop; and it is obvious that the parties to the Chadbourne agreement are at liberty to dispose of any lots of old segregated sugar so long as the segregated quota is kept up.

Mikusch came out late in August with his first estimate of European production for 1931 and was followed shortly after by Licht's latest figures of the area sown with beets. Both statisticians coincide pretty closely in respect to area. Mikusch registers a decrease in Europe, excluding Russia, of 17·43 per cent. and in Europe with Russia an increase of 0·07 per cent. area. As for production Mikusch puts the respective figures at 25·13 per cent. decrease and 13·80 per cent. decrease. That is, for Europe excluding Russia a metric tonnage of 6,447,000, as compared with 8,611,000 tons in 1930. Licht does not yet venture on an estimate of sugar production. The chief participants in the reduction are Germany, France, Czechoslovakia, Poland and the United Kingdom. But the weather has not had its final say, and a month hence we

shall be on surer ground. Other crop indications include : U.S. Beet, which will be some 70,000 tons less ; Peru where a drought has cut the crop down by 10 per cent. ; Porto Rico, Santo Domingo and the B.W.I. where beneficient rains had given a fillip to the coming crops. But taking the sugar world as a whole retrenchment seems to be the prevailing order of the day.

The Statistical Position in Europe.

Messrs. C. Czarnikow have lately published an interesting table outlining the statistical possibilities in Europe during the coming sugar campaign. Leaving out Russia, as to which statistics remain a dark horse, they estimate the 1931-32 production on two bases : (1) on the exceptionally high yield of sugar per hectare in 1930-31, and (2) on the average yield of the past six years. The former results in an all-Europe crop of 7,190,000 metric tons raw value ; the latter on one of 6,190,000 tons. They estimate the consumption at 8,780,000 tons, so under (1) the deficit works out at 1,661,000 tons and under (2) at 1,866,000 tons. Adding to these figures an estimated 700,000 tons, the amount of exports to outside Europe, the net deficit, which must be replaced by imports of cane sugar, is 2,361,000 tons based on the last crop yield, or 2,566,000 tons based on the average yield. These figures compare with estimated imports of cane sugars during the 1930-31 season now ending of 1,560,000 tons, representing an increase in requirements of 801,000 tons or 1,006,000 tons respectively.

Since the above calculations were published, the estimates of Dr. Mikusch have appeared and put the production excluding Russia at 6,447,000 tons, or 257,000 tons more than the 6,190,000 tons above referred to. But of this excess 200,000 tons relates to the five "Chadbourne" countries, whose export is limited to the agreed quota, so there is only a matter of some 32,000 tons difference in the figures assumed by Messrs. Czarnikow and those of Dr. Mikusch. All the same, it is yet early to take either of these figures as anything like final, since the weather of the next few weeks may still have an important influence on the crops. But as possibilities these deficits are undoubtedly interesting and offer, if borne out, a valuable contribution to the restoration of the statistical position of sugar.

Centrifugal Sugar Production in the Philippines.

From the official compilation of the centrifugal sugar production in the Philippines for the past three crop years from 1928-29 to 1930-31, one learns that, as previously estimated, the past crop turned out to be about equal to the previous one, showing but a slight increase of some 12,000 tons or less than 3 per cent. The 1930-31 figures are : Negros, 491,690 long tons ; Luzon, 231,880 tons ; Panay, 43,972 tons ; Mindoro, Cebu and Leyte, 17,700 tons ; total 785,242 tons, as against 773,674 tons in 1929-30. Compared with the 1928-29 crop, the volume of the crop just harvested is 98,000 tons larger, or an increase of 14 per cent. This increase is due to the expansion in the production of centrifugal sugar in the islands of Panay, Cebu and Leyte, where a few small centrifugal mills have been erected during the last three years in districts where formerly muscovado sugar only was produced. It is to be noted that the increase in the sugar production in the Philippines in the past few years has been largely due to the change in the process of manufacture as a result of the replacement of the antiquated muscovado mills by modern centrals. This change, however, is already practically completed, so that no material increase in production is expected from this source in the near future.

The increased production in 1930-31 was also due to the slight increase in the centrifugal sugar production in the island of Negros, due to favourable

weather conditions On the other hand, the total production in the island of Luzon has decreased from 260,713 tons in 1929-30 to 231,880 tons in 1930-31, because of unfavourable weather during the past crop.

The centrifugal sugar production during the period under review demonstrates that, with the present existing Centrals in the Philippines, there will be no abnormally large increase in the sugar production within the next few years, and that any increase resulting from higher yields per hectare will be normal and, it is hoped, it will be absorbed by local consumption. It is to be noted in this connexion that a recent compilation by the Philippine Sugar Association of the sugar consumption in the Philippines for the past six years shows that the consumption of centrifugal sugar in the Islands has more than doubled from 32,571 long tons in 1925 to 75,601 long tons in 1930.

British Colonial Sugar Crop Reports.

From Barclay's Bank (D.C. & O.) Monthly Review we compile the following information on recent conditions in the British sugar colonies. *Mauritius.*—Since the cyclone in the Spring, the weather has been particularly favourable to the standing sugar canes which in many districts appear to be making a good recovery from the damage ; the sugar factories in the north of the island began crushing in mid-August, and it is reported that the sucrose content is fairly satisfactory. The erection and equipment of a factory for the manufacture of gunny bags from local fibre is nearing completion, and will lead to a revival in the fibre industry. *Barbados*—Owing to the drought the 1930-31 sugar crop has proved much below the average, not exceeding 55,000 tons as compared with a normal crop of 80,000 tons. Since May the weather conditions have been very favourable for the new crops, rains having been plentiful, so cultivation is in excellent condition. *Trinidad.*—Reaping for the 1931 sugar crop is now finished and all the factories have closed down. The total crop, amounting to 98,155 tons, is a record for Trinidad, and it is understood that this is due principally to an increase in the amount of canes purchased from farmers and the almost entire absence of the froghopper pest. The previous record was 89,858 tons in 1929. More recently steady rains have been experienced and the weather conditions throughout Trinidad have been exceptionally good. The 1932 cane cultivation is looking healthy ; the rains have brought along the growth of the canes, particularly the young plants, which had suffered somewhat from the long period of dry weather. Labour has been plentiful for all purposes, but unemployment is becoming more apparent owing to the slackness of trade generally. *Jamaica.*—The reaping of the 1931 cane crop has been progressing satisfactorily, weather conditions having been favourable. More recently the rainfall has been exceptionally heavy, frequent thunderstorms having brought torrential rains. *Leeward Islands.*—Owing to the drought, the grinding of the 1931 crop in Antigua which was completed in June was expected to be slightly over 5000 tons, compared with a total of 18,257 tons in 1930, while in St. Kitts the crop is estimated at 12,500 tons, against 18,701 tons in the previous year. The drought broke at the end of April, and since then good rains have continued and the new cultivation has responded to the much needed moisture following a period of drought which in St. Kitts is reported to have been the worst experienced for 60 years. *British Guiana.*—Satisfactory rains have prevailed in this colony following the break of the drought, and conditions have been favourable for growing crops. The Spring, or first, sugar crop is finished and although a fair one it is reported to be about 2870 tons less than the total of 51,273 tons for the corresponding crop of last year.

Plantation Research in Queensland.

The Bureau of Sugar Experiment Stations in Queensland has undergone considerable changes in its organization during the last few years, and it may be useful to summarize the present position for the benefit of readers of this Journal. The Bureau contains three old-established experiment stations, namely at South Johnstone near Innisfail in the north, at Mackay in the centre, and at Bundaberg in the south. At each of these there is a chemical laboratory, whose chemist in charge is responsible for the work on the station. Owing to the long continued study of insect pests on the canes there are, besides, three entomological laboratories, an old established one at Meringa near Cairns in the north, and more recent ones at Mackay and Bundaberg, with entomologists in charge. The headquarters of the Bureau are at Brisbane, the capital, where the Director, H. T. EASTERBY, has for many years had his office and, during the considerable expansion which has taken place in the last few years, laboratories have also been built there for the central research on soils and for plant pathology. The latter have now been completely equipped and the Bureau may well be considered to have reached its final development : while the general and administrative work is still in the hands of the Director, the research has been separated into four Divisions : Soils and Agriculture under H. W. KERR, Pathology under A. F. BELL, Entomology remaining under E. JARVIS, and the new Division of Sugar Mill Technology under N. BENNETT.

As pointed out in our review of last year's work, the Division of Soils and Agriculture deals with the whole of the plantation research excepting the study of pests and diseases of the sugar cane, and the present article will be confined to the many-sided activities of this Division. Of co-operative fertilizer trials, the first series of farmers' plots have been harvested, twelve in northern Queensland, ten in central and ten in southern, and the majority of these have been continued for first ratoons. The crop returns from the fertilizers have been very satisfactory. With few exceptions, highly profitable returns have resulted from even the heaviest applications, ranging from 600 to 800 lbs. per acre. Although the season has not been favourable, where good spring rains were experienced, as in parts of Mackay district, gains of from 10 to 11 tons of canes per acre have been reached. The full returns from these plots are now being prepared for separate publication in pamphlet form and will be distributed among the farmers Meantime a fresh series of experiments has been arranged during the planting season, eight for the Northern division, 16 for the Central and 8 for the Southern. Parallel investigations on the chemical compositions of the soils in the plots have also been carried out in the Brisbane laboratory, in order to correlate analytical and field results.

A complete study of the agricultural value of waste by-products has also been opened, chiefly with regard to molasses, filter-press and subsider muds, and trash residues. A molasses trial has been harvested at the Bundaberg experiment station, recording conclusively the value of this substance on the red soils of this tract, known to be deficient in potash, and it is intended to extend the trials to the soils at Mackay and South Johnstone.

A study of irrigation waters of the Burdekin delta was begun in May and, although under unfavourable conditions during the year, the work will be continued at the Brisbane laboratory, and it is hoped soon to obtain a complete analysis of every irrigation water in this tract. During four months of the year a preliminary survey was made of the chief cane soils in the country. This reconnaissance survey will be of great advantage in laying down the general lines of a complete survey of the cane soils, but it is unfortunate that a full time officer will not be available for this work.

During the year the first series of Latin squares and randomized blocks were carried through on the Experiment Stations, the results showing the decided advantage of this experimental technique over the older type of lay out of the plots; two trials at South Johnstone showed the remarkably small experimental errors of 1·4 and 0·3 per cent. respectively. At Bundaberg where the volcanic soil has shown great variability as judged by experimental observation in the past, the difficulties involved have been largely eliminated by the use of 5 × 5 Latin squares; indications up to the present being that six replicates may be required for each treatment to obtain the desired degree of precision. The plots laid out at Mackay are being re-organized to render them more suitable for the revised experimental plan: no new blocks were laid down this year; after the harvest half the plots will be dug out, and the other half dug out next year, and a new series laid down in the following planting seasons.

Seedling work can only be carried out at South Johnstone because of the cold dry winter at the other stations, which prevents the growing on of the seedlings. An attempt to make use of heating frames for the germination and early growth was successful in raising over 1000 seedlings in each place. It is estimated that several thousand may be raised in this way at each of the southern stations, and if so this will become a major project in the near future.

Of the Variety trials, those with SJ 4 in the north and POJ 2714 at Mackay are the most important. SJ 4 has been tried on poorer soils at Cairns, but under the dry cold of last winter has developed a great amount of leaf scald. This is put down to the stock of this seedling having become heavily infected on the station, only showing itself under adverse conditions. The distribution of this variety is held up till disease-free material is available. POJ 2714 appears to be suited to the Mackay district and is being welcomed by the growers; but it has disadvantages, being susceptible to certain diseases, showing tendency towards pithiness, and early flowering.

The experiment field days were suspended during the year, and in their place district field days will be held with the collaboration of the local growers' executives; as by this means a greater number of individual farmers will be reached. The work going on in the three experimental stations is then given in the usual detail, each being preceded by a study on the rainfall and frosts which have so much influence on the results. The Reports of the officers in charge are printed, and the following notes on them are presented.

South Johnstone Station. E. J. Barke.

Meteorological.—The early planting weather (April to June, 1929) was extremely favourable, 8·27 in. falling during these months; but the later planting during the early spring months (July to October) was less successful, only 5·29 in. of rain falling, and only 5·92 in. fell during November and December. Thus far, with over half the year gone, less than 20 in. had fallen and the cane growth was backward. But heavy, soaking rains then fell with high humidity during the rest of the season, and by April 30th, 1930, the crops had reached their normal growth. The total rainfall for the growing period from September, 1929, to August, 1930, was 129·92 in., as against the average of 127·08. The average tonnage of canes in the plots on the farm (24 acres) was 38 per acre.

The following experiments appear to be of interest. Cultural and manurial, which was carried on to the 2nd ratoons: *subsoiling* to 18 ins. versus ordinary cultivation to 12 ins. The average annual gain during the three crops of sub-soiling on this type of clay loam was 4·0 tons of canes. The addition of 1 and 2 tons of *burnt lime* per acre was also continued to the 2nd

ratoon crop, with a resulting increase of 14 tons with 1 ton, and 23 tons with 2 tons during the whole period. The conclusion drawn is that at least one ton of burnt lime should be added in each such period of rotation (during five years) to maintain the soil condition favourable for optimum crop production. The plot with an addition of one ton of *coral limestone* was continued to the 1st ratoon crop and, although slower in action than the burnt lime, showed an increase in yield as effective, making the usual allowance that 1¾ tons of limestone is equal to 1 ton of burnt lime. *Soaking the plant cane* in various solutions, also carried to 1st ratoons, showed that while there was a distinct gain in yield with the plant cane crop, this gain was not maintained during the ratoon crop. In the *varietal trial* of SJ 4, as compared with the standard cane Badila and other cane varieties, the former maintained its marked superiority. But unfortunately this variety showed two faults, in that its CCS content is appreciably lower than the standard and that in unfavourable conditions it readily succumbs to leaf scald, which prevent its adoption as a superior commercial variety.

Fertilizer trials with *fallowed* as against non-fallowed treatment gave interesting results. The plots were arranged in four randomized blocks, two fallowed and two non-fallowed. The preparation of the land was as follows : fallowed land had cowpeas planted in November, 1928, ploughed under in June 1929, after rotting the land ploughed and harrowed four times, and planted in August, 1929. Non-fallowed had previous cane stools ploughed out in July, the land ploughed and harrowed four times and planted in August. All the plots received 100 lbs. of KCl per acre, and of them four plots received no further manure, which may be considered as no manure plots ; and four each received 400 lbs. super and 400 lbs. ammonium sulphate, 400 lbs. super and 200 lbs. ammonium sulphate, 200 lbs. super and 400 lbs. ammonium sulphate, and 200 lbs. super and 200 lbs. ammonium sulphate. The respective gains from the additional 200 lbs. sulphate of ammonium and 200 lbs. super are compared for the fallowed and non-fallowed plots. As might have been anticipated, the leguminous crop in the former had supplied practically all the amount of nitrogen which the crop needed, and little response to sulphate of ammonium was observed; here the available phosphate was the limiting factor. With the un-fallowed land, the phosphate gave less increase, as the nitrogen became the serious limiting factor. From a consideration of the results it is evident that much heavier dressings would have yielded profitable increases in crop yield, particularly of phosphates. The heaviest dressings amounted to 900 lbs. per acre. Incidentally, the standard error in this experiment was estimated as 1·43 per cent.

MACKAY EXPERIMENTAL STATION. F. KEOGH.

The average rainfall here for the past twenty eight years has been 64·4 in., or about one-half that of South Johnstone ; and, during the past year, it was decidedly unfavourable to cane growth, 55·2 in. falling during the growing period, September 1929 to August 1930, and the distribution of the rains was also bad, 29 in. falling in January and 8 in. in May, and 18 in. during the rest of the year. As was the case in the previous year, there was a dry period from June to December (8·47 in.), followed by a poor distribution in the wet season. The average tonnage of canes on the experimental plots was 15·1 per acre. As noted already, the plots at Mackay are to be dug out and rearranged.

BUNDABERG EXPERIMENTAL STATION. J. PRINGLE.

Following the severe winter of 1929, the past season was for the most part favourable, in spite of hot dry and cold spells, the latter of which caused little

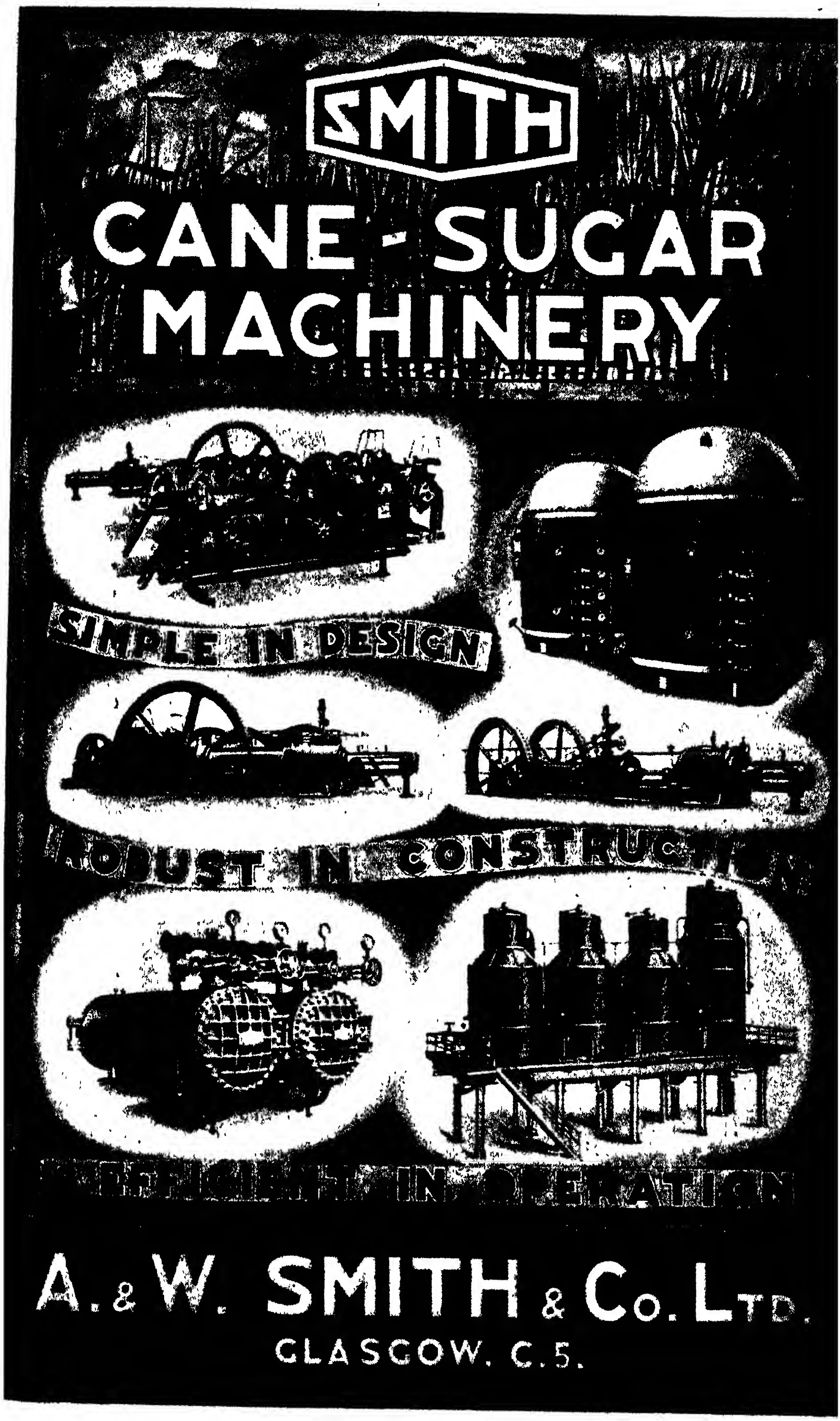
positive damage to the crop. The rainfall during the growing period (September 1929 to August, 1930) was 50 in., as against 33·69 in the previous year, with a fall of 23 in. from December to February and 7·4 in. in June. The average tonnage on the experimental plots (24·40 acres) was 20·57 per acre, the chief variety grown being Q 813.

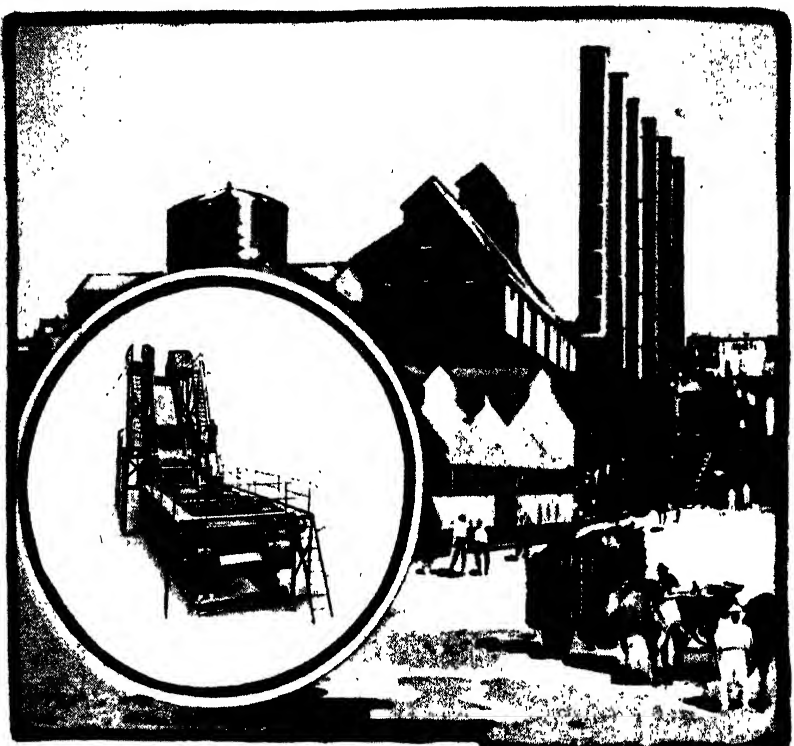
The first three experiments emphasize the importance of potash on the red volcanic soils. The first also demonstrated that N and P are necessary at least for ratoons. The second experiment (plant canes *after cowpeas*) gave significant increases after single and double doses of ammonium sulphate which was rather abnormal on a plant crop following green manuring. The probable explanation appeared to be in the rain falling between the digging in of the cowpeas and the planting of the cane, and the leaching out on this porous soil of any nitrate accumulated. The green manuring crop was dug under in February 1929, cross ploughed and harrowed in March, ploughed again in June and later harrowed, and planted in September : 8·63 in. of rain fell between April and June. The third or *potash trial,* all plots receiving 200 lbs. of sulphate of ammonium and 150 lbs. of super. They were then manured with 100, 200, 300, 400 and 500 lbs. of potassium chloride, with the result that, while some increase was obtained with the 200 dose, no further amount produced anything beyond. The plots in the last two experiments were arranged in 5 × 5 Latin squares, with standard errors 3·65 and 3·23 per cent.

Phosphate trials.—Five plots with the following treatments : No manure, 300 lbs. KCl, 300 lbs. KCl and 200 lbs. ammonium sulphate, and these two with 150 and 300 lbs. super added. The results showed that the addition of the chloride of potassium alone was sufficient to convert a total failure into a fair crop (7·42 tons of cane per acre with no manure and 19·98 with KCl added). The addition of ammonium sulphate gave no further rise, even with 150 lbs. super ; but with 300 lbs. super there was a significant increase (to 22·58 tons). But the results of this experiment must be considered abnormal, because the block had been under lucerne (without manure) for two and a half years previously. It is a popular belief that cane cannot be grown successfully on the red volcanic loams following lucerne, and this experiment appears to supply the solution of the problem. Lucerne is a heavy feeder, and with continuous cutting much of the scanty supply of potash naturally occurring in these soils is removed. The standard error was estimated as 5·84 per cent.

The *molasses trial* has already been referred to ; the following are the details of this experiment. This land had been under lucerne for two years prior to March 1928, when it was ploughed and fallowed. Light ploughings were given in May and October, followed by deep ploughing in July, 1929. At the end of August it was harrowed, rolled, and the molasses applied evenly at the rate of 10 tons to the acre over the treated plots Dry conditions followed and the molasses remained to a large extent unchanged till the middle of October, when good rain fell. The land was harrowed, drilled and planted shortly after, the plots being one-fifteenth of an acre with molasses and without : these were replicated in five randomized blocks. A good strike was obtained in all plots, which grew uniformly until the wet season (December onwards), when the treated plots went ahead, and maintained their lead until harvest. The tons of cane reaped averaged 37·09 per acre from the treated plots and 22·69 from the untreated. Undoubtedly, this increased yield was due to the potash and nitrogen added in the molasses. The plots will be ratooned without any fertilizer in order to determine the residual effect of the molasses.

C. A. B.


SMITH
CANE-SUGAR
MACHINERY
SIMPLE IN DESIGN
ROBUST IN CONSTRUCTION
EFFICIENT IN OPERATION
A. & W. SMITH & Co. Ltd.
GLASGOW. C.5.



The Inset above shows a
13-ROLLER CANE MILL.

COMPLETE FACTORIES
FOR CANE OR BEET SUGAR

Cane Mills and Crushers
Filter Presses - Juice Heaters
Vacuum Pans—Coil or Calandria

DUNCAN STEWART & CO., Ltd.

LONDON ROAD IRON WORKS
GLASGOW

Established
1864.

Cable Address:
"STEWART, GLASGOW"

Sole Distributors, in Great Britain and Ireland, of BÜTTNER ROTARY DRYER for the Sugar Industry.

Sugar Cane Sorghum Hybrids.

An Appeal for Seeds of Wild Sorghum.

By T. S. VENKATRAMAN, Government Sugar Cane Expert, India.

Having raised intergeneric hybrids between the sugar cane (POJ 2725) and sorghum (Sorghum Durra, Stapf) for the last two seasons—over 75,000 in number—and having secured in the hybrids undoubted evidence of their hybrid nature, the time would appear to have arrived for fully developing this work.

The chief use for this hybridization would appear to lie in the possibility of breeding short duration canes. Seven hundred hybrids planted out during the first season have yielded half a dozen types maturing in six months and with satisfactory juice. One direction, however, in which they could be improved with advantage, is in the matter of tonnage. In future crossings it is proposed to use as parents on the sugar cane side, not only canes more vigorous in growth than POJ 2725, but also various forms of vigorous growing *Saccharum spontaneum*, of which a certain number are available at Coimbatore.

It is now desired to secure a collection of wild sorghums to try and introduce vigour—i.e. tonnage—from the sorghum side also. The writer will feel highly indebted to persons or institutions that would kindly favour him with such seeds. Through the kindness of the authorities in the U.S.A. and Hawaii, a fair collection of the sweet or " honey " sorghums has been secured. The seeds now desired are of wild sorghums with plenty of vegetative vigour and good tillering. The seeds will need to be fumigated and certified as above before despatch. All such help will be gratefully acknowledged in future publications.

Lawley Road P.O., Coimbatore, South India.

Sugar Cane Research in Natal and Zululand.

FIELD TRIALS OF VARIETIES AT MT. EDGECOMBE, THE NATAL SUGAR EXPERIMENT STATION. **H. H. Dodds and P. Fowlie.**

Series A.—This consisted of the comparison of five varieties which had been grown for some years in Natal. They were obtained before any of the varieties imported under the new quarantine scheme were available in sufficient quantity for field experiments; and were planted in 1926 and reaped some twenty months later, in 1928, and the 1st ratoons at about the same interval in 1930. Four varieties are included in this experiment : Seedling 1900 (hailing from Mauritius), Badila, POJ 213, D 1135. Four plots were planted of each and five of Uba for comparison. The yield of plant canes was, in the same order, 17·20 tons per acre, 15·33, 25·44, 22·99, as against 23·32 tons for Uba. The sucrose per acre was 2·75 tons, 2·70, 4·02, 3·26, and 3·37. POJ 213 thus gave the best results both of cane and sugar, followed by Uba, D 1135, Badila and Seedling 1900. The rainfall was poor, 58·5 in. during the twenty months.

The canes were cut in July-August, 1928, and the ratoons were cultivated in the usual way and manured : the rainfall being better, 67·0 in. and well distributed. The yield of the 1st ratoons was, in canes : 20·68, 15·87, 29·89, 29·04, and 32·41 ; and in sugar per acre 3·16, 2·51, 4·32, 4·15, and 4·90 tons. Taking both crops together, there was thus no appreciable difference between POJ 213 and Uba, both were superior to D 1135 and more distinctly to seedling 1900

and Badila. The latter two showed characteristically high sugar content with low fibre, but are evidently unsuitable for these poor, dry soil conditions. D 1135 is more hardy, but inferior to Uba and POJ 213 under the conditions—a clay loam, distinctly acid, with very poor drainage qualities, and very deficient in moisture holding capacity and in ordinary plant foods. All of these varieties are furthermore subject to mosaic, although the POJ 213 remained free from attack in the experiments and proved highly resistant to streak disease.

Series B—This experiment was started in October, 1928, and included the first batch of the newly introduced varieties of which sufficient material had been accumulated. These varieties are placed in the order of merit as far as can be gathered from the harvest of the first crop of plant canes in July, 1930 : Co 205, Co 210, Cuban Selection, CH 64/21, Uba, SC 12/4, POJ 213, Agaul, Kavangire, Oshima, Townsend's Selection, Merthi. POJ 2714 was also included, but was withdrawn as it was cut irregularly for replanting. Co 205 with 8·86 tons of sucrose per acre and Co 213 (8·56) were distinctly, and Cuban Selection (7·95) and CH 64/21 (7·93) perhaps slightly better than the Uba standard (7·51) ; and Kavangire (7·08), Oshima (6·74), Townsend's Selection (6·31), and Merthi (5·33) were distinctly inferior to the Uba in the plant cane at least. The remainder (7·17 to 7·41) may be regarded as more or less equal to Uba within the limits of experimental error and under the conditions of this experiment. Co 205 and Co 213 are not likely to be released for commercial planting during the present season, but evidently have possibilities in competition with Uba in certain rather dry conditions such as these.—" They are both reedy canes bred for severe conditions of drought and extremes of temperature. According to the present indications, some of the later Coimbatore varieties should prove superior to these, in which case Uba will not enjoy much longer its undivided monopoly, even in our drier soils."

The ripening season was exceptionally early at Mt. Edgecombe in 1930, because of the low rainfall in the latter part of the summer after January : the rainfall received by the crop during its 20 months in the ground was 66·05 in., of which only 9·36 fell during the last six months. The site of this experiment was a rather heavy clay loam of a fair depth, and was apparently formed from the weathering of a doleritic hill cap, very characteristic of this part of Natal, with a stiff clay subsoil presenting difficulties in drainage. It had been under cane for about 50 years continuously, being allowed to lie fallow for about a year, with crops of buckwheat ploughed-in in succession. Each of the varieties was planted in quadruplicate plots of one twentieth of an acre, each consisting of four lines 5 ft. apart and 109 ft. long.

CO-OPERATIVE FERTILIZER EXPERIMENTS ON ST. ANDREWS ESTATE, EMPAGENI. **H. H. Dodds and P. Fowlie.**

Before entering on a description of this interesting series of experiments, it is well to review the various difficulties which the authors mention as having been encountered. In advanced countries, such as Hawaii and Java, with large staffs of trained scientific experts, it is the custom on large estates to lay down well-arranged series of fertilizer trials in collaboration with the local management ; and literally hundreds of such experiments are conducted every year. In Natal, however, the conditions are such that the work of this character can only be undertaken in rare cases, where the local technical knowledge is available, and other conditions are favourable. This may be due to the past history of the industry and especially to the long reign of the Uba

cane, to which all kinds of soil will suffice to produce profitable crops. The whole subject is in its infancy, as the results obtained will abundantly testify.

The present paper records an attempt to study the rich loamy soil which is found on a large area of sugar cane lands in Zululand. " Our first experiment laid down here showed the remarkable response of this soil to fertilizer, even to the relatively unavailable raw rock phosphate, a response that was greatly enhanced by the application also of nitrogen, whether in the inorganic form of ammonium sulphate or the organic form of blood meal. This response was shown not only in the plant cane crop, but also in large measure in the first and second ratoons, without further application of the fertilizer, the total profit from the fertilizer over the three crops being truly remarkable as shown below. Although this fertile soil will yield good crops without any fertilizer at all, one of its principal assets is that it will show such a remarkable response to a moderate investment in fertilizer."

The soil reaction was *pH* 6, and it was well supplied with nutrients, including 0·15 per cent. nitrogen, 0·024 available potash, but only 0·001 available phosphorus as P_2O_5. The field was planted with Uba cane in December, 1924, and thereafter harvested every two years. It was divided into 16 small areas, 40 × 50 ft. in extent, every alternate one being maintained as a control without fertilizer, and the others being treated with Egyptian raw rock phosphate at 350 lbs. per acre at the time of planting. Two sections were also treated with ammonium sulphate at 500 lbs. per acre, and two with blood meal at the same rate ; other two sections had a like amount of ammonium sulphate as a top dressing three months after planting. The following are the results obtained, in tons of cane per acre.

	Plant Canes Dec. 1926.	1st Ratoons Aug. 1928.	2nd Ratoons Aug. 1930.	Value of increased yield per acre less cost of fertilizer. £	s.	d.
Control	19·54	33·46	32·01	——		
Rock phosphate only	28·28	40·04	33·56	15	6	5
Rock phosphate with top dressing of ammonium sulphate	30·64	40·06	35·62	16	6	4
Rock phosphate with ammonium sulphate at planting	32·96	43·98	37·94	22	8	7
Rock phosphate with blood meal at planting	33·34	41·22	37·25	20	15	3

In view of these results, the authors point out that it is certainly remarkable that at the second ratoon cutting there should be still a marked benefit from fertilizer applied six years previously, after two heavy crops had been reaped. And observe that this fertile soil, rich in organic matter and of high moisture holding capacity, can evidently assimilate an insoluble material like raw rock phosphate in a way that is impossible in the light sandy soils or in the far less fertile clay loams of the experiment station. It can also utilize ammonium sulphate apparently without the toxic effects that may take place in more acid soils.

The second experiment was to test various forms of phosphatic fertilizer to see if any other form was more profitable than rock phosphate. This was conducted in an adjoining field of exactly similar soil and planted in March, 1927. The different substances tried represented 90 lbs. of phosphorus as P_2O_5, in triplicate plots of about one tenth of an acre planted with Uba cane. Thus (1) 500 lbs. of superphosphate ; (2) 300 lbs. of raw Egyptian rock phosphate ; (3) 410 lbs. of bone dust ; (4) 470 lbs of basic slag ; (5) 375 lbs. of equal portions of super and rock phosphate, and (6) 450 lbs. of super and bone dust

per acre. The cane was harvested in November, 1929, and the results were, in canes per acre: No fertilizer 30·78, (1) 43·94, (2) 37·50, (3) 44·92, (4) 43·78, (5) 41·46, and (6) 43·43. Bone dust gave the highest yield, but not sufficient to pay for the extra cost of this manure as compared with super. As to profits obtained over the no manure plot, super led with £8. 14s. 5d. and rock phosphate was last with £4. 18s. 5d. The plots will be due for harvesting as ratoons during the next season, if suitable transport arrangements can be made to continue the experiment.[1] Assuming that super is the best form of phosphate to apply, a further test was put down in February, 1930, to determine the amount required from nil through 250, 500, 750 lbs. per acre, while maintaining a basic dressing throughout of 200 lbs. of ammonium sulphate and 100 lbs. of potassium chloride per acre.

Having shown in the first experiment that there is an excellent response to *N* as ammonium sulphate or blood meal up to the first and second ratoon crop, it was decided to test the relative effects of sodium nitrate and ammonium sulphate. This experiment was laid down in a deep red loam that had been broken up from typical thornbush veld about a year previously. Each plot consisted of five lines of canes, 5 ft. apart and 178 ft. long, or about one-tenth of an acre, with an unfertilized dividing line between every two plots. The treatment was as follows, besides the control of the fertilizer: (1) super 500 lbs. per acre, (2) super 500 lbs. and ammonium sulphate 245 lbs., (3) super 500 lbs. and 320 lbs. sodium nitrate. Each plot was planted in quadruplicate with Uba in December, 1928. The soil at planting time was noticed to be unusually dry for the time of year, when the fertilizers were placed in the furrows. The plots were harvested in December, 1930, and produced the following yields: Control 49·08, (1) 59·02, (2) 60·21, (3) 61·35 tons of cane per acre. The usual great benefit was derived from the super alone, and the slight gain from nitrogenous manure was more than counterbalanced by a fall in sucrose content in the canes—12·5 and 12·7 against 13·4 and 13·1. This failure of response to nitrogenous manure may be put down to the virgin soil or dry season at the commencement. It seems probable that abundant moisture must be present in the soil to get a response from such manures.

The last series of experiments was devoted to potash, and consisted of a control with no fertilizer, a basic dressing of phosphate, phosphate and ammonium sulphate, and to the latter added potassium sulphate as 60 lbs., and 120 lbs., or 50 lbs. of potassium chloride. The no manure plot yielded 44·14 tons of cane: the basic dose of phosphate 52·67 and the PN plot 50·34: all of the potash plots were between the two latter. The greatest profit was obtained from the P plot £6. 0s. 7d.; and there was no evidence of any increase in sucrose content from the addition of the ammonium sulphate and the various amounts of potash. One may say therefore that, in the soil represented in these experiments, the application of 500 lbs. of super per acre or more will be beneficial; the addition of ammonium sulphate should only be made when planting in moist soil during rainy weather: and apparently there is no response to potassic fertilizer in dry conditions.

C. A. B.

LECTURES ON SUGAR TRADE.—On the 21st of September courses at the City of London College commence on: (1) Marketing of Sugar by Mr. W. O'Toole, Secretary to the Sugar Association of London; (2) Economical Geography and Statistics of Sugar by Dr. E. W. Shanahan; and (3) on the Analytical Examination of Sugar, consisting of practical classes on the estimation of moisture, ash, sucrose, and invert sugar in samples of sugar.

[1] The extension of the railway to near St. Andrews Estate, it is stated, will make this estate no longer suitable for experimental work.

The Periodic Change in the Flow of Sugar to the World Market.

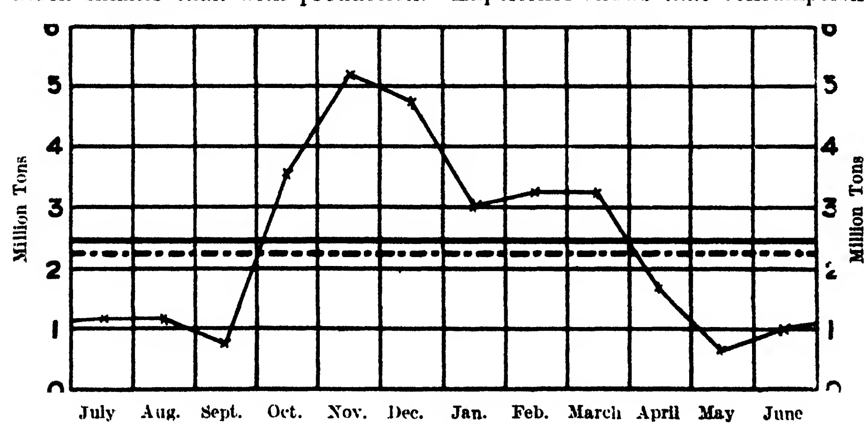
By RUDOLF E. GROTKASS, Magdeburg.

For several years past the author has endeavoured to study the tidal change in sugar production throughout the course of the twelve months of the year. In time it was possible to secure improved basic data on the length of campaign in the different countries for these rather difficult calculations. Statistics on the monthly production of Cuba and Java are now coming regularly to hand. While therefore the accuracy of the total estimates, for lack of much of the required material, still leaves much to be desired, yet it may now be considered possible to take a broad view of the monthly development of the world's sugar supply. These calculations and the graphic representation of the values found permit an insight into the function of the flow of sugar that reveals some surprising facts.

By far the larger part of the total volume of the sugar produced does not reach the primary market in a condition fit for consumption, but as a raw product, and it comes into the hands of the consumers only after the lapse of the time required for the refining process. Still the influence on the market price of sugar rests almost exclusively with the raw product. On the other hand, speculators, the sugar trade, and more particularly the refineries, act as regulators on the further quantitative movement into the consumers' hands.

The author has endeavoured to represent the monthly flow of raw sugar during the 1930-31 campaign in the form of two graphs.

In Graph I the first curve shows the total monthly production of sugar in the world. Besides this curve, the graph shows two straight lines, of which the upper represents the monthly average production and the lower the monthly average consumption, based on the available figures from 1929-30. Sugar consumption is of course also of a fluctuating nature, but the deviations are much smaller than with production. Experience shows that consumption



GRAPH I.

Total World's Sugar Production during every Month in the Year 1930-31.

during the period of canning and preserving in the summer months is somewhat higher. But any attempt to estimate its course must remain an impossible undertaking, due to a total lack of data. Recently published figures for the monthly distribution of refined sugar in the United States indicate a maximum for the months July-August and a minimum for December-February with the proportion of 16 : 10 for July-December. The percentage

of distribution for the four yearly quarters is 22·2, 27·2, 28·5 and 22·1, rather even.

The analysis of the graph of the total world's production shows the following : During the campaign of 1930-31 a crop of 29·8 million tons was produced with a monthly average of 2·483 million tons. Consumption, as estimated by Dr. MIKUSCH for 1929-30, amounted to 27·1 millions with a monthly average of 2·258 millions. The graph shows a most pronounced tidal wave with six months of flood during October-March and six months of ebb during April-September, with the curve running accordingly above and below the straight average line. The flood shows two marked culminating points, of which the highest appears in the month of November and the other in February/March. The production of beet sugar is responsible for the crowding of the last quarter of the year. The other culminating point is formed mainly by the production of the East and West Indies. The depression between the two is a consequence of modern sugar technology tending to shorten the campaign and of increased efficiency. Nowadays the beet sugar factories normally do not work any longer into January, and the West Indian crop, particularly that of Cuba, does not begin as early as formerly.

The ebb tide shows two low points in September and May. The last one is determined through the nearly complete cessation of activities in Cuba, due to the increased capacity of the Centrals. Since Java has not come into full action at this time, there results the lowest point of the year. The second low point in September is determined through the reduction in the work of the Java mills, while the production of beet sugar, apart from a few exceptions, has not yet begun.

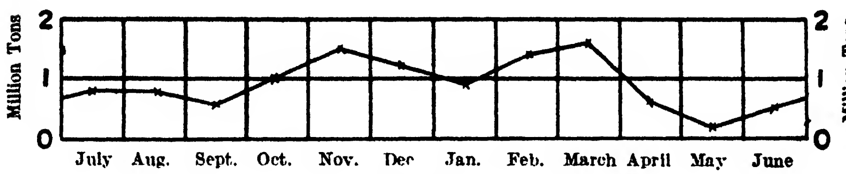
Of the 29·8 million tons produced in the last campaign, 23·2 million tons were manufactured in the six months of October-March, that is over three-quarters of the yearly total. The monthly average of the flood period reaches 3·87 million tons. The ebb period April-September furnishes only 6·6 million tons or less than a quarter of the yearly total, and represents an average of only 1·1 million tons.

The figurative development of world production in the course of the months during the year 1930-31 is shown in the following table :—

Flood Period.	Tons.	Ebb Period.	Tons.
October	3,600,000	April	1,700,000
November	5,200,000	May	700,000
December	4,800,000	June	1,000,000
January	3,000,000	July	1,200,000
February	3,300,000	August	1,200,000
March	3,300,000	September	800,000
Total	23,200,000	Total	6,600,000

But besides the demonstrated periodic change repeated every year in the course of production, it appears that the shifting from ebb to flood is very sudden. The month of September shows a minimum production of only 800,000 tons which leaps in November all at once to 5·2 million tons, meaning about six and a half times the former figure. The return to the ebb level of 700,000 tons in May proceeds more slowly and in two distinct movements. Besides this demonstrated tidal wave of ebb and flood, the yearly curve shows three vaults. The first from September-January results mainly from the production of beet sugar, the second in January-May from the East and West Indian sugar production, and the third in May-September is due mainly to the influence of the Java crop.

The second graph (II) represents the monthly excess production over the home requirements becoming available for export, this having a particular influence on the market price of sugar. In these quantities that exceed the home demand, the preferential sugars of Cuba for the U.S.A. and the preferential British colonial sugar for the U.K. are included. The distinction between protected and unprotected sugars is much more difficult than appears at first sight, as direct or more or less hidden indirect premiums or subsidies for the support of production or export are apt to counteract the duties of other countries. Preferential duties and drawbacks tend to efface the dividing line in many cases. The quantity of the export sugar really traded in is therefore higher by a certain margin, as shown in Graph II, because under certain conditions some countries export sugar, that do not produce enough at



GRAPH II.

Excess Production over Home Requirements.

home for their own needs, and therefore take recourse to larger imports. Some countries also import sugar, whose home demand is fully satisfied, with the object of re-exporting it. In addition to all this, the stocks have to be calculated—a most changeable factor. For all these reasons the author has confined himself exclusively to the purely excess production over the home requirements. As basis the figures of the last campaign 1930-31 from which the latest available consumption figures were deducted will serve. This excess production was distributed over the length of the campaign in the same manner as in Graph I, and will be found in Graph II.

The analysis of the second curve showing the course of the world's excess production in totals of every single country for the months in the year, gives in summary a surplus crop of 11·1 million tons. The tidal wave of six months' duration is apparent just as in Graph I. The total production in the flood period reaches 7·6 million tons and in the ebb 3·5 million tons. The highest culmination point does not lie in November as in Graph I but in March, which finds its reason simply in the fact that the West Indies produce a greater oversupply than Europe, which latter has rather high home requirements to satisfy. The three vaults, mentioned in the analysis of Graph I, are as marked in Graph II.

The figurative development of the monthly excess production is shown by the following table :—

Flood Period.	Tons.	Ebb Period.	Tons.
October	1,000,000	April	600,000
November	1,500,000	May	200,000
December	1,200,000	June	500,000
January	900,000	July	800,000
February	1,400,000	August	800,000
March	1,600,000	September	600,000
Total	7,600,000	Total	3,500,000

Here also the tidal change brings about very sudden fluctuations. From the month of September with 600,000 tons production, there is a climb to 1,500,000 tons in November. Very abrupt is the drop to the ebb level from March to May. Here production collapses from 1,600,000 tons to 200,000 tons.

This tidal wave in the sugar supply to the world's market as represented in the two curves in the Graphs repeats itself regularly every year. Changes in the production of the different countries of course influence somewhat the monthly quota, but do not shift the tidal wave. On the course of this tidal wave only two historic economic events have been able to make their mark in the last five centuries. The first was the discovery of America, with the ensuing development of the culture of the sugar cane in those territories; the second was Napoleon's continental system, which established Achard's invention of the manufacture of beet sugar in the moderate climate of Europe.

As explained above, advancing sugar technology and increased efficiency have made the division of the flood wave increasingly apparent: likewise the world war has made its influence felt on the formation of the two culmination points, because during the war and for several years after it, the monthly maximum of the year had shifted into the first quarter of the year, since Cuba had increased its production considerably and the European beet sugar manufacturers in the last quarter of the year had fallen very much behind with their output, due to the collapse of the German, Russian and French sugar industries. But beet sugar has since staged a comeback. The situation and the trend of development in the sugar producing territories make a further accentuation of the flood wave a probability in the coming years. Russia intends to increase its sugar production considerably under the five years' plan, while Cuba after the re-balancing of the international sugar situation could easily increase its production by two millions to its former output of five million tons, which, taken in all, would cause a further swelling of the flood line.

STAINLESS STEEL.—This material is being advocated for use in cane sugar factories, particularly those turning out white sugars, the value of non-rusting metal for the construction of tanks, pipes, gutters, and the like being now well recognized.

CARBONATATION IN T.H.—Kahuku Plantation in Hawaii is completing the installation of an experimental carbonatation plant for making white sugar.[1] A Taylor rotary lime kiln, 80 ft. long, using coral sand, three continuous saturation tanks, three Borden thickeners, and two continuous Olivers, are among the plant which will be employed.

BOILER SCALE PREVENTION.—According to P. Koeppel[2] the use of trisodium phosphate effectively reduces the hardness of boiler feed water to 0° by precipitating the lime, magnesia, and iron quantitatively. The flocculent precipitate coagulates floating particles of dust and adsorbs any oil in the water, thus preventing foaming. A slight excess of the Na_3PO_4 is advantageous in reducing corrosion of the boiler parts.

SPECIAL COLORIMETER.—Schmidt and Haensch have now elaborated from the Stammer or Duboscq type of colorimeter an instrument by which comparison of one liquid with another or with colour-glasses can be carried out with mono-chromatic light of different wave-lengths, viz., 610, 560, and 480 $\mu\mu$. It is recommended by O. Spengler, and E. Landt[3] for technical sugar work.

1 *Facts about Sugar*, 1931, **26**, 348.
2 *Oesterr. Chem-Zeit.*, 1931, **34**, 97; through *B.C.A.*, of August 14th and 21st, 1931.
3 *Zeitsch. Ver. deut. Zuckerind.*, 1931, **81**, 13-24; through *B.C.A.*, of August 14th and 21st, 1931.

Sucrose Determination in Sugar Factory Products by Double Polarization Methods.

B. B. BHATTACHARJEE, B.Sc., and J. H. HALDANE, Ph.D., F.I.C.

Due to the presence of optically-active bodies other than sucrose in sugar factory products, the percentage of sucrose is determined by the inversion or double polarization method, which involves determining the direct polarization, calculating the sucrose into invert sugar, again polarizing, and calculating the sucrose from the difference between the two polarizations according to the following formula :—

$$\text{Sucrose} = \frac{DP - IP}{K - \frac{T}{2}}$$

where DP = Direct Polarization.
IP = Invert Polarization.
K = Constant.
T = Temperature.

Of the various modifications of CLERGET'S original method[1] for sucrose determination, the one most widely used is that of HERZFELD.[2] This method introduces known and recognized errors : (*a*) in it the volume of the precipitate formed by the lead salts is neglected ; (*b*) the direct reading is variable dependent upon the quantity of lead salts employed, which effect is most noticeable in the presence of larger quantities of levulose ; and (*c*) the direct and invert readings are made in different media, the direct slightly alkaline and the invert strongly acid.

Various methods have been evolved in attempts to correct for these errors. The use of a minimum quantity of dry basic lead acetate to effect clarification, as in HORNE'S[3] method, aims at eliminating the error due to the volume of the precipitate formed by the lead salts, while the JACKSON-GILLIS[4] obtains a uniform medium by adding to the solution for the direct polarization a neutral salt equivalent to that obtained when the acid used for inversion is neutralized. In the latter method, however, unless the lead salts are precipitated after the initial clarification, a difficulty is met in adjusting the appropriate quantity of the salt to be added to the filtrate for the direct polarization when increased quantities of basic lead salts, with consequent increase of the precipitate error, are used in the clarification of low purity sugar-house products, such as waste molasses. In 1915, DEERR[5] evolved a method, later modified by COATES and SHEN,[6] to eliminate all sources of error by removing from the solution for the direct and invert readings the reagents employed for clarification and inversion respectively. In this method, clarification for the direct reading is effected by the addition of equimolecular quantities of barium hydroxide and aluminium sulphate, while for inversion sulphuric acid is employed, the invert reading being taken after neutralization of the acid by the appropriate quantities of barium hydroxide and aluminium sulphate. By this method, a strict double neutral polarization is obtained which, combined with a correction for the volume of the precipitate, eliminates the errors inherent to the use of lead salts.

On account of the initial expense and time involved for the determination, invertase has not as yet been adopted as an inverting agent in commercial routine analyses, but in the present investigation its use has been included as one of the methods of double polarization. In the DEERR-invertase method[7],

---

[1] *Ann. Chem. Physic.* 1849, **26**, 175. [2] *Z. Ver. deut. Zuckerind.* 1888, **34**, 699.
[3] *J. Amer. Chem. Soc.*, 1903, **28**. 186. [4] *I.S.J.*, 1920, 509, 570, 638. [5] *I.S.J.*, 1915 179.
[6] *J. Ind. & Eng. Chem.*, 1928 70 ; *I.S.J.*, 1928, 30.
[7] Using the preparation " Invertase Scales, Red Label."

SCHEDULE I.

Material.			Clerget-Herzfeld.				Jackson-Gillis.				Deerr-SO_2							Deerr-Invertase.			
		Brix.	Pol.	Pol. Purity.	Suc.	Gr. Purity.	Pol.	Pol. Purity.	Suc.	Gr. Purity.	Pol.	Pol. Purity.	Suc.	Gr. Purity.	Original Invert.	Total Invert	Calcu. Suc. from Invert	Suc.	Gr. Purity	Total Invert	Calcul. Suc. from Invert
Mixed Juice.		18·5	14·28	77·19	14·45	78·10	14·23	76·92	14·40	77·84	14·23	76·92	14·38	77·73	1 22	16·35	14·37	14·38	77·73	16·35	14·37
		19·70	15·67	79·54	15·87	80·56	15·65	79·44	15·89	80 66	15·65	79·44	15·84	80·40	1·44	18·05	15·78	15·84	80·40	18·11	15·84
		14·10	11·07	78·51	11·16	79·15	11·04	78·29	11·16	79·15	11 02	78·15	11·11	78·79	1·04	12·77	11·14	11·11	78 79	12·74	11·12
		15·00	10·86	72·40	11·00	73·33	10·86	72·40	10·98	73 20	10·83	72 20	10·91	72 73	1·35	12·82	10 90	10·93	72 87	12·85	10·93
		16·00	11·84	74·05	12·00	75·00	11·84	74·00	12·00	75·00	11·81	73 81	11·96	74·75	1·30	13·96	12·03	11·98	74 87	13·93	12·00
		15·90	11·17	70·25	11·42	71·82	11·15	70·13	11·37	71·51	11·12	69·93	11·35	71·38	1 55	13·55	11 40	11·35	71·38	13·56	11·41
Average..		16·53	12·48	75·49	12·65	76·53	12·46	75·38	12·63	76·41	12·44	75·25	12·59	76·16	1·32	14·58	12·60	12·60	76 23	14·59	12·61
Syrup.*		16·20	13·38	82·59	13·58	83·83	13 38	82·59	13·58	83·83	13·36	82·47	13·50	83·33	0·76	15·03	13·56	13·50	83·38	15·01	13·54
		15·50	12·56	81·03	12·81	82·64	12·54	80·90	12·76	82·32	12·51	80·71	12·68	81·80	0 79	14·17	12·71	12·71	82·02	14·20	12·74
		15·20	12·32	81·05	12·42	81·74	12·32	81·05	12·42	81·71	12·29	80·85	12·39	81·51	0·63	13·72	12·43	12·42	81·71	13·73	12·45
		14·90	11·29	75·77	11·41	76·58	11·29	75·77	11·36	76·24	11·24	75·43	11·31	75·90	0 59	12·49	11·31	11·34	76·10	12·49	11·31
		16·30	12·46	76·44	12·61	77·36	12·44	76·31	12·61	77·36	12·44	76 31	12·56	77·05	0·71	13·91	12 54	12·56	77·05	13·94	12·58
		15·50	11·68	75·35	11·88	76·64	11·66	75·22	11·83	76·32	11·63	75·03	11·81	76·19	0·94	13·38	11·82	11·83	76·32	13·38	11·82
Average..		15·60	12·28	78·70	12·45	79·80	12·27	78·65	12·43	79·68	12·25	78·53	12·38	79·36	0·74	13·78	12·39	12·39	79·42	13·79	12·40
Molasses.	S	98·60	32·20	32·65	38·69	39·24	32·20	32·65	38·73	39·28	30·20	30·66	36·22	36·75	22·08	60·38	36·39	36·40	36·91	60·54	36·54
	S	95·73	30·00	31·34	37·04	38·69	30·00	31·34	37·06	38·71	28 63	29 90	34 83	36·38	23·89	60·92	35·18	34·93	36·49	60·77	35·04
	C	96·40	34·00	35·27	38·54	39·98	34·00	35·27	38·53	39 97	33·39	34 63	37 10	38·48	11·32	50·56	37·28	37·26	38·65	50·47	37·19
	C	103·20	38·40	37·20	42·50	41·18	38·40	37·20	42·44	41·12	37·37	36·21	40 61	39·35	13·92	56·92	40·85	40·83	39·56	57·02	40·95
	C	101·18	36·80	36·37	40·52	40·04	36·80	36·37	40·55	40 07	35·78	35·36	38·79	38 34	10·31	51·20	38·85	38·97	38·51	51·45	39·08
	C	96·91	32·20	33·23	36·17	37·32	32·40	33·43	36·44	37·60	31·01	31·99	34·76	35 87	13·73	50·51	34·94	35·07	36·18	50·71	35·13
Average..		98·67	33·93	34·39	38·91	39·44	33·97	34·43	38·96	39·49	32·73	33·17	37·05	37·55	15·88	55·08	37·24	37·24	37·74	55·16	37·32

* Diluted Sample. *S* Sulphitation. *C* Carbonatation.

the solution under examination was initially clarified with barium hydroxide and aluminium sulphate and after the direct reading has been obtained, the filtrate was acidified with acetic acid and treated with the requisite amount of invertase to effect complete inversion in five hours at an average room temperature of 32°C. As in the Deerr-SO_2 inversion method, the constant used in the formula for obtaining the per cent. sucrose was taken as 141·7.

Efficient cane sugar factory control demands the determination of the sucrose content in mixed juice, syrup and molasses, and in Schedule I are given the analytical results of of six samples of each of these products, the following four methods of double polarization for the determination of sucrose being employed : (*a*) CLERGET-HERZFELD ; (*b*) JACKSON-GILLIS ; (*c*) DEERR-SO_2 method (with modification due to COATES and SHEN) ; and (*d*) DEERR-invertase.

In addition to the sucrose determination, under the DEERR-SO_2 and DEERR-invertase methods, are included the original per cent. invert, total invert after complete hydrolysis with sulphuric acid and invertase respectively, and the calculated sucrose content from the difference between the original and total per cent. invert sugar. For the latter determinations, the copper and alkaline tartrate solutions were standardized under the precise routine as carried out in all analyses against preparations of invert sugar obtained by hydrolysis of pure sucrose with invertase. The reduced copper was weighed as cupric oxide and a graph drawn showing the relationship between the weights of cupric oxide found and the equivalent known weights of invert sugar. In the determination of total invert, the mgms. invert sugar were noted from the graph in relation to the weight of CuO found and a similar procedure was adopted in the determination of the original invert, in the presence of sucrose, and a correction then applied according to MUNSON and WALKER's Table.

In addition to the analytical results set forth in Schedule I, a similar series was carried out on six samples of gur[1] and gur refinery molasses respectively, and these are given in Schedule II.

SCHEDULES.

An examination of the results as given in Schedules I and II shows that as the purity of the materials analysed decreases or with an increase of the original invert sugar content, or due to a combination of both, a greater divergence appears between the results as determined by the CLERGET-HERZFELD and JACKSON-GILLIS methods, and those by the DEERR-SO_2 and DEERR-invertase methods. Accepting the sucrose content determined by the DEERR-invertase method as standard, and considering the tabulated average results only, the deviation from this standard can be more readily realized from the following statement.

	Deerr-Invertase Sugar Per Cent.		Deerr-SO_2 Sugar Per Cent.			
	Standard.	Calculated from Invert.	Determined.	Calculated from Invert.	Jackson-Gillis Sugar Per Cent.	Clerget-Herzfeld Sugar Per Cent.
Mixed Juice	0·00	+0·01	—0·01	0·00	+0·03	+0·05
Syrup	0·00	+0·01	—0·01	0·00	+0·04	+0·06
Waste Molasses	0·00	+0·08	—0·19	0·00	+1·72	+1·67
Gur	0·00	+0·13	—0·09	—0·01	+0·47	+0·45
Gur Molasses	0·00	+0·06	—0·13	—0·09	+1·36	+1·38

[1] Gur, Gul or Jaggery can be defined as cane juice concentrated to solidification in direct fired pans, without purification except occasionally the addition of a small amount of alkali and the removal of scums.

SCHEDULE II.

Material.		Clerget-Herzfeld.				Jackson-Gillis.				Deerr-SO_3							Deerr-Invertase.			
	Brix.	Pol.	Pol. Purity.	Suc.	Gr. Purity.	Pol.	Pol. Purity.	Suc.	Gr. Purity.	Pol.	Pol. Purity.	Suc.	Gr. Purity.	Original Invert	Total Invert	Calcul. Suc. from Invert	Suc.	Gr. Purity	Total Invert	Calcul. Suc. from Invert
Gur.	99·40	74·40	74·85	76·43	76·89	74·40	74·85	76·56	77·02	73·90	74·34	75·78	76·24	9·11	88·96	75·86	75·94	76·39	89·16	76·05
	98·70	71·20	72·14	73·24	74·20	71·20	72·14	73·40	74·36	70·77	71·70	73·28	74·24	8·08	85·32	73·38	73·34	74·30	85·32	73·38
	97·80	72·60	74·23	74·09	75·76	72·40	74·03	74·04	75·70	71·96	73·58	73·64	75·29	9·36	86·70	73·47	73·74	75·40	87·09	73·84
	97·80	70·20	71·77	72·74	74·37	70·00	71·57	72·45	74·80	69·58	71·14	72·12	73·74	9·53	85·61	72·28	72·13	73·75	85·71	72·37
	96·90	70·40	72·65	72·90	75·23	70·40	72·65	72·93	75·26	69·58	71·80	71·98	74·28	10·47	86·40	72·13	71·98	74·28	86·60	72·32
	97·80	71·20	72·80	73·86	75·52	71·20	72·80	74·03	75·69	70·37	71·95	73·25	74·89	9·86	87·09	73·37	73·46	75·11	87·09	73·37
Average..	98·07	71·67	73·08	73·88	75·33	71·60	73·01	73·90	75·35	71·03	72·43	73·34	74·78	9·40	86·68	73·42	73·43	74·87	86·83	73·56
Gur Molasses.	95·23	37·60	39·48	43·69	45·87	37·60	39·48	43·71	45·89	36·97	38·82	42·19	44·30	28·55	72·61	41·86	42·44	44·56	72·80	42·04
	96·91	36·60	37·76	42·64	43·99	36·50	37·66	42·44	43·79	35·78	36·92	41·08	42 39	25·29	68·61	41·15	41·19	42·50	68·84	41·37
	97·84	37·00	37·81	42·95	43·89	37·20	38·02	42·99	43·94	35·78	36·57	41·00	41·90	24·21	67·54	41·16	41·11	42·01	67·77	41·38
	97·36	37·00	38·00	43·00	44·17	37·10	38·10	42·85	44·01	36·18	37·16	41·73	42·86	23·58	67·61	41·83	41·84	42·97	67·70	41·91
	96·24	36·60	38·03	42·68	44·35	36·80	38·24	42·66	44·33	35·78	37·18	41·09	42·69	23·57	66·92	41·18	41·13	42·74	66·92	41·18
	97·93	38·20	39·01	43·50	44·42	38·40	39·21	43·71	44·63	37·37	38·15	42·30	43·19	24·22	68·92	42·47	42·49	43·39	69·15	42·68
Average.. .. .	96·92	37·17	38·35	43·08	44·45	37·27	38·45	43·06	44·43	36·31	37·46	41·57	42·89	24·90	68·70	41·61	41·70	43·03	68·86	41·76

The close agreement between the sucrose as determined by the Deerr-invertase method, and that as calculated from the difference between the original invert and total invert after complete hydrolysis with sulphuric acid and invertase respectively, substantiates the adoption of the invertase method as the standard for the determination of the sucrose content of sugar-house products. Accordingly, from the above it may be stated that the Deerr-SO_3 method gives results only slightly below the standard, while the Jackson-Gillis and Clerget-Herzfeld give positive results, the divergence or error increasing as the purity of the product analysed decreases.

It may be of interest to note that although the average original invert sugar content of gur molasses appears as 24·90 as against only an average of 15·88 for cane molasses, the average divergence from the standard sucrose content of the molasses samples as determined by the Deerr-invertase method and that as determined by the methods of Clerget-Herzfeld and Jackson-Gillis appears as +1·37 in the former as against +1·70 in the latter case. This difference can be attributed to the fact that in the case of gur molasses a smaller quantity of lead salts is found to be necessary to effect clarification than in the case of cane molasses. In regard to the latter, it may be observed from Schedule I, that the original invert sugar content of the sulphitation molasses is approximately 100 per cent. greater than that of the carbonatation molasses, and in view of the fact that approximate equal quantities of Pb salts are necessary to effect clarification in either case, it is of interest to note the sucrose divergence from the standard as shown below :—

	Average Original Invert Sugar.	Deerr-invertase Sugar Per Cent. Standard.	Deerr-invertase Sugar Per Cent. Calculated from Invert.	Deerr-SO_3 Sugar Per Cent. Determined.	Deerr-SO_3 Sugar Per Cent. Calculated from Invert.	Jackson-Gillis. Sugar Per Cent. Determined	Clerget-Herzfeld, Sugar Per Cent. Determined.
Sulphitation Molasses	22·99	0·00	+0·12	—0·14	+0·11	+2·23	+2·20
Carbonatation Molasses	12·32	0·00	+0·05	—0·21	+0·05	+1·46	+1·40

Sulphitation molasses with an average original invert content of 22·99 per cent. give with the Jackson-Gillis and Clerget-Herzfeld methods of double polarization an average positive error of 2·22 per cent. sucrose, while in the case of carbonatation molasses with an average of only 12·32 per cent. original invert sugar, the average positive error is 1·43 per cent. sucrose. It is evident, therefore, that the divergence from the standard in the case of the Jackson-Gillis and Clerget-Herzfeld methods is dependent upon the amount of lead salts necessary to effect clarification and also on the per cent. of invert sugar originally present in the materials analysed.

A consideration of the quoted analytical results appears to prove conclusively that the double polarization methods of Clerget-Herzfeld and that of Jackson-Gillis, especially with low purity factory products, such as waste molasses, give results with a high positive divergence from the standard; and consequently if adopted for factory control analyses on mixed juice, syrup and molasses, will affect the boiling house control data and the sucrose balance. For example, according to the *sjm* formula, and using the average gravity purities of syrup and molasses (carbonatation and sulphitation) as shown in Schedule I, the calculated possible boiling house recovery according to the four methods of double polarization would be as follows when $s = 100$.

	Carbonatation.	Sulphitation.
Deerr-invertase (Standard)	83·96 ..	84·98
Deerr-SO_2	84·04 ..	85·00
Jackson-Gillis	83·23 ..	83·70
Clerget-Herzfeld	83·37 ..	83·84

In the case of sulphitation factories with the quoted gravity purities of syrup and molasses, the standard possible boiling-house recovery would have been reported as 84·98 per cent., as against only 83·84 per cent. and 83·70 per cent. had the syrup and molasses been analysed according to the methods of JACKSON-GILLIS and CLERGET-HERZFELD respectively, results which would no doubt tend to obscure losses of sucrose.

Of the four methods investigated, the DEERR-invertase method gives results least incorrect, followed by the DEERR-SO_2 method which gives results slightly below those as determined by invertase while the JACKSON-GILLIS and CLERGET-HERZFELD methods give positive results, the positive divergence being dependent upon the quantity of lead salts employed to effect clarification and increasing in the presence of larger quantities of levulose. As the invertase method takes too long for commercial purposes, and is rather expensive, the DEERR-SO_2 method is recommended for adoption in cane sugar factories where efficient control necessitates the determination of the sucrose content of mixed juice, syrup, waste molasses and sugars.

Java Technical Notes.

MANUFACTURING METHODS OF THE JAVA SUGAR FACTORIES. **P. Honig.** *Report of Committee on Factory Practice and Equipment, Hawaiian Sugar Planters' Association*, 1930.

On being asked by the Chairman of the above-mentioned Committee what Java is doing in her factories to meet the low prices of the present time and near future, Dr. HONIG made a statement, the substance of which is as follows: Regarding recent changes in the quality of the output delivered to the market, these are in the direction, (1) of improving the white sugar by dissolving after-products and re-crystallizing them; and (2) of the production of raw sugar acceptable to the refiners, that is, having an even grain, low ash content, and a low colour degree.

Extraction.—Development is in the direction of preparatory machinery such as shredders and knives as a means to increase grinding capacity and extraction. Maceration as a factor in extraction makes little progress because the steam consumption is rather high in obtaining a proper exhaustion. Better results are obtained with the hot treatment of the bagasse in trough carriers, the effect of which is a better imbibition action while killing the closed cells. According to the opinion of Java technical advisers, hot treatment means pressing with less power consumption with drier bagasse. Extension of mill installation is excluded under present price conditions. *Clarification.*—To screen the raw juice, a quick-action vibrating screen frequently takes the place of the former drag-carrier screens. Juices are quite generally pumped unstrained by open fan-pumps, the Sulzer and Walwin pumps often being used. Liming in defecation takes place more and more at higher temperatures with a pre-liming of say one quart of milk at 15°Bé. per 264 U.S. gallons. The advantage of the hot-liming with dilute milk-of-lime of 2°Bé. is that the maximum *pH* can be maintained with great accuracy, which is absolutely excluded with cold-liming. In the white sugar factories the customary clarification method is carbonatation, which has the advantage of intensive

removal of non-sugars, and gives 2 per cent. higher rendement than the sulphitation method. *Filtration.*—For carbonatation and sulphitation muds good results are obtained with Vallez presses: Sweetland presses proved less satisfactory on account of the large quantity of sweet-water required. This season trials are being made with Borden thickeners and Oliver filters for first carbonatation mud. Clarified juice sulphitation is practised in all carbonatation factories, with a careful check on the reaction, so that it is possible to keep inversion during evaporation down to 0·2 per 100 polarization.

Evaporation.—Roberts cells, practically always with one or more centre wells are customary; the material is brass, sometimes Munz-metal, steel tubes having entirely disappeared. Experiments with Monel-metal gave no reason for adopting this material. In many factories it has become customary to arrange for five mutually interchangeable cells, of which one is always being cleaned. *Syrup treatment.*—In most factories the syrup is taken into the pans without any treatment except sulphitation. In exceptional cases it is filtered with kieselguhr or sand, but it is undecided yet if the extra cost is compensated. Opinion is that improvement in the quality of the syrup must come in the first place from clarification. *Boiling.*—Coil-pans are used, although calandrias are frequently found as well, though not giving as good results for after-products. Pan construction is much improved in recent years and it is becoming more the practice to specify what is wanted instead of accepting what is prescribed. Graining of commercial strikes is generally done in the purest material available, that is, in the evaporator syrup. Graining takes place usually by waiting for the supersaturation point, although a more regular grain is obtained by shocking (taking in cold water or suddenly changing the vacuum). But these manipulations require routine and skill and the panmen do not always have this. Intake of syrups and molasses is generally not continuous, largely so because pan equipment such as valves, arrangement of supply-tanks and the irregular dilution and heating of the syrups make it very difficult. Work is being undertaken, however, to make this crystallization process continuous. Different types of cooling devices in the crystallizers have been tried, the "Werkspoor" rapid crystallizer giving good results. *Centrifugals.*—During recent years a study has been made of washing pre-dried sugars, so as to arrive at the arrangements of mixers, etc., operating methods, Brix, temperatures, etc., in connexion with liquors to be used in this affination process. It is necessary that the pans be equipped with liberal steaming-out pipes so that all parts and particularly dead corners are reached. Since the quantity of colouring matter per cent. non-sugar increases materially by steaming, it is advisable not to mix this liquid with the massecuite in the mixer but to take it back with the molasses.

PLAN OF WORK OF THE EXPERIMENT STATION FOR 1931. *Archief*, 1231, **39**, deel I, No. 2, 19-28.

Each year[1] the E.S. announces its "plan of work" for the agricultural, chemical and technical divisions; and this, for 1931, may be summarized as follows: *Chemical* (1) Analysis of samples received. Each factory may send in to the E.S. once a month a sample of its molasses produced in the current period for analysis (Brix., pol, sucrose, reducing sugars, and sulphated ash), in order thus to check up. A sample of its sugar can also be submitted at least once a month. Special samples, e.g., those arising out of any abnormal working, are also willingly examined by the Station. (2) Investigations on

[1] See also *I.S.J.*, 1930, 249.

methods of analysis ; on the behaviour of the ash constituents in manufacture on the determination of different nitrogenous compounds (proteins, peptones' amino-acids, amides, ammonium compounds) ; on the determination of the colour of sugars ; on the determination of the affinability of raw sugars ; and on the compilation of tables correlating Brix from 75-90° with temperature.

(3) Specifications for different materials used in manufacture, including filter-cloth and materials for packing sugars. (4) Calibration of glassware, and the standardization and stamping of balances, weights, and polariscopes. (5) Reporting on various questions arising out of manufacture. (6) Investigation on the mechanism of thick-juice (evaporator syrup) filtration ; use of the pan refractometer in boiling ; use of conductivity apparatus, etc. (7) Possibilities of utilizing bagasse and molasses, including the isolation of cellulose from the former. *Technical.*—Standardizing and stamping gauges, indicators, thermometers, pyrometers, water-meters. Repairing instruments (when this can be done). (3) Reporting on questions relating to installations (5) Fortnightly reports on milling. (6) Ditto, on fuel control. (7) Experiments with installations such as Meinecke cane knives, Searby shredder, and like preparatory appliances ; the collection of data on Bruyn floating top-rolls, electrically driven mills, juice weighing apparatus. Investigations on matters relating to boiler circulation, extent of losses in unburnt particles passing up the factory flue, factors affecting slag formation, etc.

CENTRIFUGAL CLARIFICATION TESTS. **G. Benthem.** *Archief*, 1931, **39**, I, No. 20, 539-541.

Last season four De Laval centrifugal separators were installed in the Tjoekir s.f., where they were used to clarify all the green *C*-syrups and all the molasses syrups. They were put into operation intermittently during fortnightly periods for the purpose of comparison, the particular object in view being to observe the effect of the treatment on the quality of the final products. Here are average analyses of the molasses sugars :—

	Made from centrifuged syrups.		Made from uncentrifuged syrups.
Brix	97·65	..	97·80
Polarization	95·65	..	96·05
Sucrose	95·8	..	95·05
Reducing sugars	0·673	..	0·615
Ash	0·315	..	0·363
Moisture	2·250	..	2·050
Suspended matter per kg.	0·141	..	0·277

these showing (as one would expect) that centrifuging had diminished a little the amount of ash and of suspended matter. Some of the figures obtained in the case of the *S.H.S.* (white) sugars are as follows :—

	Centrifuging.		Not centrifuging
Moisture	0·058	..	0·060
Polarization	99·040	..	99·350
Reducing sugars	0·058	..	0·060
Ash	0·037	..	0·048

Besides this improved ash figure, sugars made from centrifuged syrups had a better colour and the grain was more regular, so that altogether it can be said that the centrifugal treatment had a favourable effect on the quality of the product. Figures for the molasses purities gave the impression that the treatment had some good effect in this direction also, the Sucrose/Brix values during the experimental periods being 32·18 and 33·38°, as compared with 33·51 and 33·91 obtained when the clarifying machines were not running.

Labour-Saving Devices in Hawaii.

Mechanical Dischargers for Centrifugals.

In a Report to the Hawaiian Sugar Planters' Association Mr. J. N. S. Williams deals with mechanical dischargers for centrifugal machines. First he gives some particulars regarding the 796 machines used in the 39 factories of the Association, 611 being belt-driven (steam engine or electric motor), 124 water-driven (Pelton wheel on spindle), and 11 having a direct electric drive on the spindle. Of the 226 machines in use for No. 1 raw sugars, 171 have baskets 40 in. diam. × 24 in. deep, 36 have 30 in. × 14 in., and 10 have 36 in. × 20 in. Of the 570 machines for the low-grades, 303 have baskets 30 in. × 14 in., 218 have 40 in. × 24 in., and 26 have 42 in. × 20 in.

Centrifugals having baskets 30 in. diam. are said to be too small to admit of an effective design of mechanical discharger ; but where these devices are in use on the larger machines the time from starting to fill one charge to starting to fill the next charge is 4 to 6 minutes, compared with 6 to 9 min. by hand, an average difference of 2½ min. Since a 40 in. machine dries about 400 lbs. of No. 1 sugar per cycle in 1 hour it would deal with 4800 lbs. with unloaders and 3200 lbs. when working by hand.

R. P. Johnson, Mill Supt., Ewa Plantation Co., stated that mechanical dischargers were in use on all his commercial sugar machines, being found a decided advantage. The same number of men are required, but they complete the drying in less time, while giving a better control of moisture. Now he can dry to a definite polarization, leaving a clean screen, and without damaging it. This latter is a matter of adjusting the speed of the basket while discharging. Fibre tips are placed on the dischargers, and replaced once a week, the screen lasting at least two crops.

Wm. Lougher, Supt. of Puunene Mill, gave the following general particulars of electrically operated machines. The total sugar that can be dried by one 40 in. self-discharging machine is 70-75 tons in 24 hours ; time per cycle on *A*-strikes is about 4 min., and on *B*-strikes of 74-76° purity about 4¾ min. ; time to discharge a machine, 10-20 secs.; weight of dry sugar recovered from a machine per discharge 450 lbs. ; diam. of the basket being 40 in., normal inside depth side-sheet 24 in., overall depth basket and hub 41 in., and speed, 1200 revs. per min. His machines are 40 in. × 24 in. Roberts improved type directly connected to a vertical, type K.T.R. squirrel cage induction, 2-speed motor, 30 H.P., 3-phase, 400 volts, 60 cycle, 600/1200 revs. per min. Power required 4·72 K.W.H. per ton of sugar dried.

Advantages of electric drive with self-discharging baskets are : greater output, lower moisture content, and less operating skill. The equipment is simple, positive and economical in operation, and because of the few parts subject to wear the maintenance expense is low. These machines have worked out to a remarkable degree in speeding up production, and in maintaining the moisture content to a degree of uniformity unequalled in previous years, thus improving the keeping quality of the sugar.

Water-Cooled Crystallizers.

At Ewa formerly it took 7-8 days to get the massecuite ready for drying, but now with water-cooled crystallizers this period is reduced to 3-4 days, that is from 145 to 84°F. using water at 73°F. Important advantages result : Sugar remains in the house for a much shorter time, thus decreasing

loss by deterioration. It does not mean fewer men, but it relieves them of extra work. Swelling of the massecuites has practically stopped. No storage tanks are required. To get the best results there should be a rapid flow of water through the coils, and as rapid a movement of massecuite past the cooling coils as possible.

CATERPILLAR-WHEEL WAGONS FOR CANE HAULING.

Wagons with caterpillar or crawler-type wheels were found so satisfactory by the Hawaiian Agricultural Co., Pahala, that after trying six they now have 41 in operation. Each has a capacity to transport from 300 to 500 tons of cane per daylight day, depending on the length of haul, the economical limit being from 1½ to 2 miles. Seven are made into a train, which is hauled by a 60 H.P. tractor. A train of empties is left in the field while a train of full wagons is being hauled to the mill. Four 60 H.P. tractors are used for this service.

The wheels used are the Athey 6-ton truss type, the wheels being fitted with ratchet brakes and tractor hitch couplers at each end of the body. A pair of these wheels has a ground contact of 9 sq. ft., and is suitable for carrying heavy loads over soft or sandy ground. They do not cut up fields nor injure cane stools as does the standard type of cart. In wet weather cane can be brought to the mill that otherwise could not be transported. In short, the advantage of the wagon is that it will convey a much larger load than the standard type of cart, hauling equivalent loads with very much less power. But they have a high initial cost, viz., about $1200, and they have not been in use long enough to learn the length of their life. In Cuba it is expected that they will last about 10 crops.

THE DIESEL LOCO.

Two Diesel locos were in use in 1929 for the first time on Kekaha and Waiakea plantations, both of the Plymouth type, and both of 12 tons with two pairs of drivers. In each the motive power was provided by an 80 H.P. Atlas Diesel engine having a maximum operating speed of 650 revs. per min., the drive being similar to that used on some tractors and trucks.

The over-all thermal efficiency of the Diesel engine is about 33 per cent., whereas that of the most efficient steam loco is about one-quarter of this. Records of the cost of Diesel oil and lubricating oil state about $1·52 per day, taking the cost of the former at $0·052 and of the latter at $0·814 per gallon, whereas the corresponding expense for a steam loco doing the same work would be about $15, or a difference of as much as $13·48 per day.

It is true that the steam loco has proved to be extremely reliable under almost all conditions on a plantation; and whether the internal combustion loco will prove to be equally so can only be determined after it has been in use for some time. The cost of its repairs and upkeep will only be known after a number of years. However, the introduction of this type of loco on sugar plantations is an innovation of interest, and in view of the extraordinarily low cost of fuel consumed by its engine is a development to be carefully watched.

ABSOLUTE ALCOHOL.—In a recent article on the production of absolute alcohol for use as motor fuel and for application in chemical industry, Dr. Fritzweiler and K. R. Dietrich[1] discuss how ordinary rectifying plant for making ordinary 96 per cent. spirit may be converted into equipment for turning out 100 per cent. alcohol by the azeotropic method by the introduction of additional valves, conductors, etc.

[1] *Zeitsch. Spiritusind.*, 1931, **54**, 155-157.

Abstracts of the International Society of Sugar Cane Technologists.

Under the scheme instituted by the I.S.S.C.T. a collection of abstracts of papers on agricultural and technical subjects is prepared monthly. A selection from these "Sugar Abstracts" has been made by us from the material last issued, and appears below :—

Beet Sugar Manufacture.

Advantages of Preliminary Liming of Beet Juice. **E. Naehring.** *Deut. Zuckerind.*, 1931, **56**, 219-220. **E. Troje.** *Ibid.*, 1931, **56**, 248-249.

These papers discuss the benefits resulting from liming beet juice in two stages. The first operation is the addition of lime to bring the juice to an alkalinity of about 30-35 mgrm. CaO per litre, re-heating to about 80-90°C., adding additional lime, and carbonatating. The two most prominent results are greater ease of filtering and reduction of the quantity of lime necessary to 1·5 per cent. CaO. The filter-cake is easily washed to a sugar content below 0·5 per cent.

Sulphuring Middle Thick-Juice. **K. Solon.** *Centr. Zuckerind.*, 1931, **39**, Festausgabe, 493-496.

The object of the research was to ascertain what became of the sulphur used in sulphuring the thick-juice. Immediately after the sulphuring process 91·1 per cent. of the total amount of sulphur used was found in the thick-juice as sulphite and 4·9 per cent. as sulphate. The proportions of the total sulphur found as sulphite in later stages of the process were as follows : 1st product, 2·58 per cent. ; 2nd product, 0·34 per cent. ; molasses, 6·29 per cent. Of the total amount of sulphite found in the thick-juice, analysis of the end products accounted for 9·21 per cent. as sulphite, 6·98 per cent. as sulphate, and 30·60 per cent. in the form of other sulphur compounds ; a total of 46·79 per cent. The rest, 53·21 per cent., must have gone into the incrustations.

Over-Carbonatation. **R. Kargl.** *Zeitsch. Zuckerind. Czechoslov.*, 1931, **55**, 479-493.

Exceeding the normal end-point in carbonatation results in the resolution of magnesia from the scums, which means more incrustation in the evaporators, more difficult filtration, lowering of the purity, foaming, difficult pan boiling, poor work at the centrifugals, and the like. Investigations at the Prague Experimental Institute on the conditions under which magnesia goes into solution in carbonatated juices showed this to depend largely on the ratio between the Ca and the Mg salts of the juice, and particularly on the presence of ammonia, which favours the effect with the form of magnesium-ammonium carbonate, which is not decomposed more than 50 per cent. by boiling for one minute. When the alkalinity of the juice is high, the magnesia may of course also appear in the form of bicarbonate.

Boiling a Good Sugar. **A. Hinze.** *Deut. Zuckerind.*, 1931, **56**, 552-553.

A discussion of the author's patented system of sugar pan-boiling, in which grain is formed in one pan and the mass is concentrated to a point such that when half the contents are drawn into a second pan the heating surfaces of both pans will be covered. The mass in both pans is then finally concentrated and discharged. Meanwhile grain is being formed in a third pan, which will be divided in the same way with one of the previously emptied pans while a new batch is started in the other. This system is used by two German factories.

RETURN OF MOLASSES TO THE DIFFUSION BATTERY. **I. B. Minz,** *et al.* *Naukovi Zapiski,* 1930, **9**, No. 5-6, 399-431.

This extensive work is addressed to the question whether return of molasses to the diffusion battery would increase the over-all recovery of sugar from beets by keeping some of the non-sugars in the beet cossettes from entering the diffusion juice, the theory being that the colloids, etc., already in the molasses would hinder the movement of similar substances, but the work with both green syrup and final molasses led to no clear positive result, though some indication that molasses has some effect on the amount of non-sugar diffusion from the cossettes appeared to be obtained.

POLISH BEET MOLASSES (1929-30). **K. Smolenski,** *Gaz. Cukro.*, 1931, **38,** 269-287.

	Maximum.	Minimum.	Average.
Bg.° (dry subs.)	86·38	75·99	81·41
Direct Pol.	53·31	45·70	50·40
Purity	64·93	56·17	61·91
Ash	12·08	8·24	9·98
Org. non-sugar	25·06	18·38	21·23
Org. non-sugar/ash	2·49	1·88	2·13
Total nitrogen	2·12	1·51	1·77
Org. non-sugar/nitrogen	9·65	6·42	8·45
Colour on 100° Bg.	854·00	257·00	457·00

AUTOMATIC SUPERVISION OF SUGAR FACTORY OPERATIONS. **K. Dabrowski.** *Cent. Zuckerind,* 1931, **39,** 630-631.

The author has invented a system by which operations at any pump station or in any pipe line of a sugar factory can be signalled by a lamp in the office of the superintendent or manager. If there is a hold-up anywhere, an electric lamp is illuminated and the time lost is recorded. This system enables the superintendent to have a complete check over all stations and has been found of great efficiency in maintaining a high level of output.

NETHERLANDS SUGAR FACTORY RESULTS, 1930. **C. W. Schonebaum.** *Tijdschrift,* 1931, **26,** 237.

Average results for 1930 are given as follows :—

DIFFUSION JUICE.		THICK JUICE.	
Purity	90·81	Purity	94·20
Ash on 100 Bx.	2·36	Ash on 100 Bx.	2·04
Sucrose on 1 ash	38·48	Sucrose on 1 ash	45·73
Sugar on 1 org. non-sugar	13·30	Sugar on 1 org. non-sugar	25·19
Org. non-sugar on 1 ash	2·89	Org. non sugar on 1 ash	1·82
THIN JUICE.		MOLASSES.	
Purity	93·95	Purity	61·11
Ash on 100 Bx..	2·08	Ash on 100 Bx.	12·68
Sucrose on 1 ash	45·17	Sucrose on 1 ash	4·82
Sugar on 1 org. non-sugar	23·66	Sugar on 1 org. non-sugar	2·33
Org. non-sugar on 1 ash	1·91	Org. non-sugar on 1 ash	2·07

IMPORTANCE OF CONDUCTOMETRIC MEASUREMENTS IN SUGAR FACTORY OPERATIONS. **W. Kopperl.** *Deut. Zuckerind.*, 1931, **56**, 267-268.

Most papers published on electrometric ash relate to its use for determining the rendement of raw sugars. But valuable information may be obtained by determining the electrometric ash even of the thin-juice. It may also be used to determine the economic limit to extraction in beet diffusion batteries. Thus, a sample of juice may be taken from the next to the last diffuser cell and its ash determined electrometrically. A simple calculation will show the amount of molasses to be expected, from which a proper

limit to the extraction may be deduced. In the same way the expected output of sugar and molasses can be computed for any other product, as the thick-juice, for example.

CANE SUGAR MANUFACTURE.

SUCROSE RECOVERY FROM LOW GRADE MASSECUITES. **R. H. King and C. Ramos.** *Sugar News*, 1931, **12**, 233-241.

After a two months' investigation involving 22 crystallizer strikes with periodic analysis of molasses separated at various temperature intervals the following conclusions are announced: Recovery by the crystallizer seems to be a function: (*a*) of the temperature at time of centrifuging; (*b*) the hours in the crystallizer; and (*c*) the purity of the original massecuite. Allowing the massecuite to remain undisturbed decreased the amount of sucrose recovered, owing to the formation of false grain. A high purity molasses separated at time of discharge from the pan produced a high purity final molasses while a low purity first molasses when separated gave a low purity final molasses. Boiling to over-capacity with a limited crystallizer will result in a low sucrose recovery, owing to the premature purging of the low grade massecuite. Stirring helped, indirectly, in the precipitation of the free sucrose in solution on the surfaces of the sugar crystals in the massecuite and checked the formation of false grain.

ELECTRIC MILL DRIVE AT KEDAWOENG. **J. J. W. den Haan.** *Archief*, 1931, **39**, III, 465. Mededeelingen No. 10.

The electric mill battery of the Kedawoeng factory is driven by direct-current obtained by transforming alternating current in a "transformer single rotor reformer." In contrast with the WARD-LEONARD coupling used at Goenoengsarie, the general speed regulation is discontinuous. The direct current potential which determines the basic speed of the motors may be set at five different potentials by means of a bleeder transformer. Altogether, this allows of a regulating range of 50 per cent. The individual regulatability is considerably higher (28·5 per cent.) than at Goenoengsarie (19 per cent.) or Redjoagoeng (15 per cent.). At the same time the gear transmission and number of revolutions of the first mill motor are adjusted as closely as possible to the naturally decreasing number of revolutions in the rest of the tandem. Although in a new, completely electrified factory which uses direct current for the mill battery and alternating current for the rest of the factory, the transformation of alternating current into direct current instead of producing this current directly will require more powerful machinery and a higher first cost, in the special case of Kedawoeng, where the rear of the factory was already electrified with alternating current and direct current was required not only for the mill but also for a pumping station, the system chosen is the least expensive. When the mill battery was electrified the steam boilers were equipped with superheaters in order to maintain the equilibrium of the steam balance. The steam economy obtained by the use of superheated steam is completely absorbed by the large amount of power delivered at the pumping station, which consumed about 37 per cent. of all the power generated. The fraction of the steam production passing through the turbine averaged 82 per cent., which means that if no power were delivered to the pumping station, this fraction would have been only 52 per cent. This indicates that the superheating fully compensates for the extra steam consumption chargeable to the electric mill drive. If there is no blow-off, the extra fuel consumption will not exceed 0·6 per cent., which is negligible.

Beet Factory Technical Notes.

Teatini Process.—Prof. D. TEATINI, in a paper which he read before the recent Congress of the Association des Chimistes des Sucreries, held at Vincennes, France, replied to the criticisms made by Dr. O. SPENGLER and ST BÖTTGER.[1] If it suffices, he said, to add the lime in two parts to obtain a good purification with a consumption of only 1 per cent. of lime, this would have been recognized long ago by those factories adding a fraction of their lime in the measuring tanks and the remainder in the defecation proper. It would also have been turned to account by factories attached to *raperies*, where a fraction of the lime has always been added to the juice before leaving the *raperie*, and the main portion at the central. But never has there been noticed the slightest improvement in comparison with factories working normally with the lime addition in one dose. Further, he pointed out, that what these German investigators stated in their paper does not coincide with what one of them, ST. BÖTTGER, said in a discussion before the Magdeburg reunion on February 7th last,[2] namely : " Our experiments have shown that at the time of the addition of a small quantity of lime, and after subsequent treatment with a little SO_2, there really is a flocculation. It is incontestable that by this process a part of the colloids is flocculated. Dr. SPENGLER has visited a factory which has worked during a very short period, and on an experimental scale by the Teatini process. It has been undeniably established that by working carefully a good flocculation can be obtained, and that less lime suffices."

Neither does it agree with the results of the experiments carried out in the laboratories of the Sugar Institute, Prague, where it has been found that liquid SO_2 in general improves the flocculation, but to a different degree, according to the nature of the juice. Liquid SO_2 is not transformed to gas when it passes from the sulphitometer into the body of the juice, that being contrary to thermodynamic law. SO_2 acts quite differently, depending on whether it is introduced into the juice as gas under low pressure, as in the ordinary method of working, or whether, as in the Teatini process, it is introduced as liquid. It is not only the amount of reagent which is thus employed, but the speed with which it is made to react, i.e., its instantaneous concentration. This has not been borne in mind by Dr. SPENGLER, as in the German factories to which he refers there were no sulphitometers. After this, Prof. TEATINI remarked that it is not possible to form judgment on a new process of manufacture, the results of which depend upon a very large number of factors after very short and very imperfectly conducted experiments made in factories which have not followed strictly the proper conditions of application, or after one or two laboratory experiments, however, carefully conducted. Then Prof. TEATINI dealt with Dr. VAN GINNEKEN'S assertion[3] that he in collaboration with Prof. AKEN had already employed the ultramicroscope for following the purification of juice from the colloidal point of view. On examining a reprint of their paper, he had failed to find any indication of the use of the ultramicroscope for the determination of the flocculation point, the SIDENTOFF method having been applied for examining the complexes formed during saturation.

White Sugar Deterioration.—One of the features of the well-known German sugar periodical, *die deutsche Zuckerindustrie*, is a column which is devoted to open discussion on technical points arising in sugar production. Often useful practical information is thus elicited, and it is generally of interest to read what is said under the heading of FRAGE und ANTWORT. In a recent

[1] *I.S.J.*, 1931, 330. [2] *Deut. Zuckerind.*, 1931, 56, No. 7, 168. [3] *I.S.J.*, 1931, 410.

issue[1] appears the following. *Question* : The granulated sugar made by us is stored in an unheated warehouse, and becomes damp even in March. Owing to our speed of working (the capacity of the factory is exceeded), the sugar is bagged hot during the campaign. On examining the sugar on July 9th last, over 1 per cent. of invert sugar was found. It is probable that on bagging the sugar was insufficiently alkaline, and that hot bagging assisted in causing the dampening of the sugar, or may it be there is another explanation ? *Answer* : Hot bagging of the sugar can hardly in itself be held responsible for its inversion. Since, according to the statement above, the sugar was kept in an unheated warehouse, and there became damp, the simple explanation of the deterioration is as follows. During the winter months the sugar in the unheated warehouse acquired the low temperature of the surrounding atmosphere. As soon as there was some warmth in the Spring, the sugar became damp. due to the warm, relatively moist air outside penetrating the cold sugar, part of its water being precipitated there. When in Spring the exterior atmosphere became warmer was the most dangerous moment. It is for this reason that the largest sugar warehouses are artificially heated. The formation of invert sugar to the extent of 1 per cent. observed in the present case was an obvious result of the dampening of the sugar.

Seitz Filter.—Hitherto it has never been possible entirely to free factory raw juice from pulp as it comes from the diffusion battery. Ordinary pulp-catchers retain only the coarse particles, allowing the fine material to go through. During the subsequent defecation the lime acts on the pulp particles, causing soluble decomposition products to pass into the juice. This adversely affects the efficiency of the process, as these products are not eliminated in clarification, but act in fact as powerful molasses formers. O. Spengler and St. Böttger[2] now point out that a complete de-pulping of the raw juice can be effected by the Seitz filter, a crystal clear juice being obtained. They carried out a series of experiments with it, which showed that distinctly less lime can be used for the clarification of the juice, though no improvement so far as purity and ash could be detected. However, the coagulation was 50 per cent. less than in ordinary juices. It was proved best to add the lime in two doses, and when this was done quite an economy in lime could be effected. For example, 0·25 CaO per cent. of the roots was added for the pre-defecation, after which 0·5 per cent. sufficed to complete the liming, thus making the total amount added only 0·75 per cent. In one series of experiments it was possible to use two doses of 0·1 and 0·6 per cent., and yet produce a clarification as satisfactory as was obtained with a much larger amount of CaO using ordinary juice. But the capacity of the Sietz filter used was found to be only 50-100 litres per sq. m. of filtering surface, which indeed is hardly practicable These experiments, however, have shown the great advantages of the de-pulping method, though some more practical means of carrying it out, perhaps by centrifuging, must be employed.

Beet Mark.—It is necessary first to decide what the mark really is, and most workers define it as "that part of the beet which is insoluble in water." This definition has been accepted by O. Kopecky,[3] who recently carried out a most thorough investigation on its determination. He first points out that in such determinations the beet itself should be used, and not beet pulp, as is generally done, as in its preparation some water evaporates, leading to somewhat higher figures. Further, in order to separate the insoluble from the

1 1931, **56**, No. 33, 850.
2 *Zeitsch. Ver. deut. Zuckerind.*, 1931, **81**, 300-311.
3 *Zeitsch. Ver. deut. Zuckerind.*, 1931, **81**, 447-486.

soluble matter, both must come into intimate contact with the water, which can take place only when all the beet cells have been opened. Then there is the point regarding the washing of the mark, whether cold water alone, or hot water alone, or water followed by alcohol and ether, should be employed. In brief, the method of operating was to rub 5 grms. of beet with some water in a mortar in order to open up all the cells, to centrifuge for 10 min. to separate the insoluble matter, and to wash the pulp with water, the actual determination being made by means of a pycnometer. Here is a summary of the average results obtained, using (1) cold water, (2) hot water, and (3) hot water with alcohol and ether, the cold water process (1) being that preferred by the author, as probably corresponding most closely to natural beet mark.

	(1)		(2)		(3)
Beet mark, per cent.........	6·542	..	6·518	..	4·862
Specific gravity	1·343	..	1·342	..	1·467
Juice content, per cent.	93·458	..	93·482	..	95·138
Volume, c.c., n. wt.	1·318	..	1·282	..	0·866

MISCELLANEOUS.

Hertenbein Filter.—K. SAZAVSKY[1] gives an account of some results with a new rotary drum filter of about 14 sq. metres surface at the Hohenau s.f. It is made by the Ersten Brünner Maschinenbau-Gesellschaft. *Microbes in Diffusion Juice.*—Bacteriological counts made by J. VONDRAK[2] of the average number of micro-organisms in the diffusion juice from five factories gave values of 800,000 to 12,000,000 per c.c. *Sodium Lamp.*—In their description of the new "Osram" sodium lamp, V. STANEK and K. SANDERA[3] mentioned a life of 3000 hours; but they now point out that this should have been nearer 300 hours for A.C. and 100 for D.C. This anyway is long enough, considering the advantages of this lamp, compared with the old system of producing sodium light. *Polarimetric Thermostat.*—The apparatus described by RAMBERG and HEUBERGER[4] is now modified by the author,[5] so that instead of the stirrer being driven from the top of the apparatus, it is now arranged from below, vibration thus being overcome. Observation tubes with cover glasses obviating any condensations are used. *Stammer Colour Unit.*—On account of the large extent to which it is in use, it is proposed by A. BRIEGHEL-MÜLLER that the Stammer unit be retained. It may be defined as 10 × the extinction coefficient of the wave-length of the blue mercury line, viz., 435 $\mu\mu$. A formula is given for calculation to other wave-lengths. *Micro-organisms in Juice*[7].—At the Raffinerie Tirlemontoise, a continuous diffusion is installed; and Prof. RASHKOVICH has conducted bacteriological tests, comparing 1st juice with that from ordinary diffusion. In ordinary diffusion, in the juice from the head diffuser there were 130,000 micro-organisms per c.c., and in that from the measurer, 800,000. In the new continuous process, in juice from the centre of the rotary sieve, the count was only 1000, that from the measurer being 15,000 per c.c. *"Rapid" Process.*—G. MICHELASSI[8] gives a description with good illustrations of this method of diffusion, which has now been installed into factories in Germany, Poland, Hungary, as well as in England. He concludes that the process entirely solves the problem of the continuous diffusion of the beet.

1 *Zeitsch. Zuckerind. Czechoslov.*, 1931, 55, 605-608. 2 *Ibid.*, 1931, 55, 601-605. 3 *Ibid.*, 1931, 55, 307-312. 4 *Centr. Zuckerind.*, 1928, 36, 1326. 5 *Ibid.*, 1931, 39, 700. 6 *Zeitsch. Zuckerind. Czechoslov.*, 1931, 55, No. 32, 403-406. 7 *Sucr. Belge.*, 1931, 50, No. 9, 152. 8 *Bull. Assoc. Chim. Sucr. France*, 1931, 47, 313-321.

Correspondence.

RESTRICTION MEASURES IN AUSTRALIA.

TO THE EDITOR, "THE INTERNATIONAL SUGAR JOURNAL."

Sir,—In your issue for May, 1931, pages 236-239, there is an article on the "Australian Sugar Industry" which has been abstracted from "The Economic & Trade Conditions in Australia." as issued by the Department of Overseas Trade. Reference is made therein to the measures taken in Australia to restrict the production of cane sugar. On the top of page 238 the details of some of the particulars of the Proclamation issued in this connexion are referred to. These have not been thoroughly understood by your contributor. The error lies in the words underlined in the following sentence :—

> "Proclamations have been issued fixing the amounts of the production of each mill, which will be regarded as their quota for home consumption and therefore entitled to the fixed price of £26 per ton."

I am sure you will be glad to have this corrected so that you may keep your records on a reliable basis.

The correct position is that a Proclamation was issued by the *Sugar Board* setting out that the maximum tonnage of sugar produced by any mill in any year up to 1929 should be the maximum amount of sugar that would be accepted by the Sugar Board in any future year for delivery to the general Sugar Pool. This Pool covers a tonnage of sugar which approximates the present production and provides the whole of the Australian consumption, the proportion for the export market being limited by the restriction of the mills to their previous maximum output. In effect, from 50 per cent. to 70 per cent. of the amount taken into this Pool is used for Australian consumption, the balance being exported. The value per ton of the total sugar thus handled is determined by the amount exported, and the value received therefore, since the value of sugar for Australian consumption is always approximately £26 per ton. As a matter of fact, for the season 1930, the year in which the system under review came into operation, the actual value of all sugar received into the Pool and sold by the Sugar Board was £19. 13s. 0d. per ton. The sugar from those mills which had "excess sugar"—that is sugar produced beyond their previous maximum—was sold, through the Sugar Board, at export values, and, consequently, the total average price for those mills was below £19. 13s. 0d. per ton.

The scheme in question, which is now known as "The Peak Year Scheme," was recommended by the recent Sugar Inquiry Commission, and has been adopted by the Commonwealth Government as part of its sugar policy in order to restrict production to the present limit, whilst by keeping exports at about the present volume, credits of an amount up to £2,000,000 are assured to the Commonwealth.

Full details of this scheme have been dealt with by the Sugar Inquiry Committee, the report of which will shortly be issued by the Commonwealth Government, and no doubt you will have a copy soon after you receive this letter.

Yours faithfully,

F. C. P. CURLEWIS,

Brisbane. *Secretary, Australian Sugar Producers' Association Ltd.*

JAVA CROP ESTIMATES.—The latest estimate of the current Java sugar crop is 2,871,193 metric tons telquel., which compares with the figure of 2,970,530 tons put forward by the V.I.S.P. on July 1st.

Fullerton-Harvey Sugar Machinery.

A New Manufacturing Development.

Producers and refiners will be interested to learn of a development which has taken place in connexion with the manufacture of machinery for the cane and beet sugar industries. A working arrangement has been completed between Fullerton, Hodgart & Barclay, Limited, of Paisley, Scotland, an engineering company established as far back as 1838, and the firm of Harvey, Ballantyne & Co., Sugar Machinery Specialists, Glasgow, whereby the former's manufacturing facilities will be utilized in conjunction with the latter's technical information and knowledge of the working conditions in the different sugar producing countries to place on the market a complete range of Fullerton-Harvey machinery.

Fullerton, Hodgart & Barclay, Ltd., have gained a world-wide reputation as manufacturers of Corliss and Drop Valve Steam Engines, Winding Engines, Air Compressors, Vacuum Evaporators and Hydraulic Pumps and Machinery. The shops at Paisley are extensive and well-equipped with modern machines capable of rapidly producing all the different varieties of machinery required in cane and beet factories and refineries. For many years there have been produced in these Shops: Heaters, Filter Presses, Vacuum Pumps, Crystallizers and Hydraulic Accumulators.

Fullerton, Hodgart & Barclay, Ltd., make an Evaporator of the "Foster" type with the segmental downtake, which gives a very free and rapid circulation. These are very largely used in the soap-making industry and have been supplied to the factories of Lever Brothers Limited and other well-known makers throughout the world. They are also extensively used in connexion with papermaking, mercerizing, and in other chemical processes where the efficient concentration of liquor is required. The makers are now prepared to estimate for the supply of these to the sugar industry. In Vacuum Pumps they make a modern unit of the reversed compressor type, which lends itself both to efficiency and low first cost.

With regard to Milling Plant, Fullerton, Hodgart & Barclay Ltd., are producing a complete range of standard sizes of an up-to-date type of mill designed for heavy duty conditions, which their admirable manufacturing facilities enable them to produce rapidly and efficiently. They are also putting on the market a complete range of Vacuum Pans, both coil and calandria, as also all the other units which go to make up a complete sugar factory or refinery, from cane knives to sugar dryers. To enable them to give the same close attention to detail as has gained them distinction in other lines, Fullerton, Hodgart & Barclay Ltd., have acquired the services of certain men trained to the sugar industry on the technical side.

Messrs. Harvey, Ballantyne & Co. have had practical experience of the working conditions in most of the sugar producing countries abroad. Both partners received their early training in the works of sugar machinery manufacturing concerns. For several years Mr. ROBERT HARVEY was a Director of the Harvey Engineering Co. Ltd., and Mr. ROBERT BALLANTYNE, in addition to his manufacturing experience, has spent several years in India as Engineer-in-charge of a sugar factory producing white sugar.

SCHARNBERG RINGS.—A leaflet is issued, and may be obtained free on application to the Farrel-Birmingham Co. Inc., of 756, Main Street, Ansonia, Conn., U.S.A., describing the application and performance of a device which eliminates common packing troubles in cane mills, and provides various important advantages, one of which is that it multiplies the packing life 3 to 6 times.

Applications of the "Salometer."

Many chemists now recognize the "Salometer," or electrical ash estimating apparatus, to be an instrument the value of which for factory and refinery control purposes is second only to the polariscope. Its feature is the rapidity with which an accurate result may be obtained. General uses to which it may be put include the following :—

(1) Determining the saline matter entering into process in the raw juice of the factory or the affined remelt of the refinery.

(2) Controlling washing operations in filters or char cisterns.

(3) Observing the efficiency of clarification, in the defecation, sulphitation or carbonatation processes.

(4) Calculating the yield of sugar or molasses to be expected from a syrup or molasses.

(5) Judging the exhaustion of a molasses, the use of the ordinary purity value being now recognized as inadequate.

(6) Indicating the quality of raw, plantation white, or refined sugars.

(7) Examining dissolved solids present in water, e.g., boiler feed or surface condenser cooling water.

(8) Ensuring the accuracy of sampling in the case of any product having a soluble ash.

LITERATURE.

Some papers on conductometric ash questions to be found in the pages of this journal are as follows : --

CALCULATION OF THE MOLASSES FROM THE ASH OF THE SYRUP. H. Pellet. *I.S.J.*, 1916, 563. "We must say that in this matter we are absolutely in accord with Mr. PITOT, since for almost three years past we have used the figure for the quantity of ash in the syrups for the estimation of the quantity of molasses to be expected, and have, moreover, verified the actual production."

REDUCTION OF THE ASH CONTENT OF RAW SUGARS. A. Giacometti. *I.S.J.*, 1918, 184. This is an investigation of the behaviour of the mineral matter of the juice throughout the process of manufacturing raw sugars, the object in view being the reduction of the amount of ash in raws in order to meet the demands of the refiners for a low-ash sugar.

ASH SUCROSE FORMULA FOR CALCULATING THE SUCROSE RECOVERY. T. Elliott and J. C. Chapman. *I.S.J.*, 1923, 607. "It would appear from the above results that the yield calculated from the *A/S* (ash per unit of sucrose) formula checks very well that calculated by the *SJM* formula, especially when based on the syrup."

ASH YIELD FORMULAE. K. Sandera. *I.S.J.*, 1930, 477. "Superior to the ordinary formulae in points of accuracy and speed are formulae based on ash values. In successive strikes there is a greater difference in the ash content than in the pol., and more precise yield figures are thus obtained."

APPLICATIONS OF THE CONDUCTIVITY APPARATUS. H. Lunden. *I.S.J.*, 1926, 560. "If in calculating the affination yield by means of the formulae of Hulla-Suchomel and others, the ash-quotient (pol./ash) be used instead of the pol. and Brix, simpler and more exact results are obtained."

APPLICATIONS OF ELECTRICAL ASH ANALYSIS. K. Sandera. *I.S.J.*, 1929, 392. "Conductivity determinations should be applied throughout the factory or refinery as they instantly indicate any irregularity." These may include : indication of the end-point in carbonatation, mineral matter in wash-waters and waste-waters, soluble matter in decolorizing carbons and the like.

Conductivity Ash Determinations. R. G. W. Farnell. *I.S.J.*, 1930, 347. " In the raw sugar factory the conductivity determination provides the chemist with a new simple means of controlling clarification, since an excessive rise in conductivity from mixed to clarified juice at once points to irregularities in defecation or filter-press work, as pointed out by Honig."

Experiments with Final Molasses. J. A. Macdonald. *I.S.J.*, 1930, 272. " Generally in raw sugar factories only the apparent purity of final molasses is determined. This figure is apt to be misleading, as it does not indicate whether all the available sucrose has been extracted or not. A cane molasses of 40 per cent. a.p. may be completely exhausted, while another sample of 35 a.p. may still contain some available sugar."

Factors Influencing the Ash Content. J. G. Thieme. *I.S.J.*, 1931, 131. During 1929 some Java factories produced molasses of very high purity. This was traced to be due to the ash factor, which has gradually risen since 1915 from 18·4 in that year to 24·2 in 1930. It would seem as if a high ash per cent. non-sugars were a property of the juice of the POJ 2878 cane. Dryness leads to a high ash content, and to a high molasses purity, climatic conditions as well as geographical situation coming into consideration in comparing molasses purities.

Factors Influencing the Exhaustibility of Molasses. J. G. Thieme. *I.S.J.*, 1931, 244. "The comparison of the exhaustion of molasses on the basis of their purity only is impracticable. Rather should one judge a molasses by means of its purity value in conjunction with its ash per cent. non-sugar quotient. . . . . . The exhaustion of molasses mainly depends on the relation of the inorganic to the organic non-sugars, the alkalis of the inorganic non-sugars exerting the greatest effect."

Publications Received.

The Physical Properties of the Soil. Bernard A. Keen. With Illustrations and Diagrams. (Longmans, Green & Co., London and New York). 1931. Price : 21s.

The practical importance of the physical properties of soil has long been recognized; indeed, these properties were among the first to be systematically studied. Tull, *circa* 1731, for example, had no hesitation in ascribing the main action of dung on soil to the crumbling effects of the ferments it contains, and asserted that the same result was obtained much more efficiently by tillage alone. Then about 1840 came the startling advances of Lawes and Gilbert in the application of chemistry to the nutrition and manuring of plants, as the result of which it appeared that a complete theory of soil fertility was in sight, so that soil physics fell into the background. In the ensuing fifty years the triumphs of agricultural chemistry were great, it is true, but with increasing experience it became evident that the fertility of the soil involved physical and biological factors as well. In recent years the whole study of soil physics has been re-opened and placed on a firm physical basis. This Monograph by Dr. Keen, who is head of the Soil Physics Department at Rothamsted Experimental Station, provides a connected and critical survey of our present knowledge of the subject. It will be read with much interest by those specializing in agricultural science by reason of its clear presentation of a branch that is being recognized to be of increasing importance. Incidentally it shows physicists some of the attractive possibilities for research in a relatively unexplored field of physics—the behaviour of moist, porous materials displaying colloidal properties.

Publications Received.

Clarification et Séparation des Liquides par la Force Centrifuge. Dr. Berthold Block; translated and brought up-to-date by Jean Lévy. (Dunod, Paris). 1931. Price : 106 fr., bound ; 96 fr. unbound.

This is the French edition of BLOCK's book, published nearly 10 years back.[1] Centrifugal machines have been adopted in different industries for the clarification of their liquids, and found to be highly successful, being in constant use, for mineral and vegetable oils, for example. But in other applications, due to the nature of the precipitate, or of the liquid from which it is to be separated, or to other reasons, sometimes economical, the results of investigations have not been successful. Those considering the possibilities of centrifugal force as a means of improving gravity decantation for the clarification in sugar manufacture of juices, and particularly of syrups, will find much of interest in this work. It deals with the various aspects of centrifuging with imperforate drums in quite a thorough manner. There are chapters on the gravity settling of solids ; on separation in reference to the size of particles ; on the nature of centrifugal force generally ; on various designs of imperforate drum machines ; on machines constructed for continuous action ; and not least in importance on the power consumption in driving centrifugals for the purpose under consideration.

The Principles of Plant Biochemistry : Part I. Muriel Wheldale Onslow. (Cambridge University Press). 1931. Price : 16s. net.

Those processes by which the plant synthesizes its carbohydrates and proteins, essential as they are, remain as yet far from being well understood. An insight into them is to be obtained from this book. It considers problems concerned with the biochemistry of the sugars and the nitrogenous compounds, the former when they take part in cell-wall formation and in respiration, and the latter chiefly in connexion with the synthesis and break-down of protein. The chapter on the sugars, their distribution in the plant, their constitution, synthesis, and biochemical significance, is an excellent one. That on oxidizing and reducing systems is particularly authoritative, as one would expect, bearing in mind the contributions made by the author herself to this branch. A knowledge of plant biochemistry must be regarded as essential to the student of agriculture, and this is a volume which can be recommended as forming an admirable introduction to the subject.

Wirtschaftliche Abwärmeverwertung im Dampfkesselbetrieb der Zuckerfabriken. Wilhelm Gumz. Tagesfragen aus der Zuckerindustrie, heft Nr. 9 (Schallehn & Wollbrück, Magdeburg, 1931). Price : RM. 2.

Contents : Introduction (History of pre-heating Air); Boiler Control and Waste Heat Problems in the Sugar Industry ; Principles and Practice of pre-heating Air ; Different systems ; Ljungström System of pre-heating Air in the Sugar and other Industries.

Die Mechanische Filtration in der Zuckerindustrie. O. Wohryzek. Tagesfragen aus der Zuckerindustrie, heft Nr. 10. (Schallehn & Wollbrück, Magdeburg). 1931. Price : RM. 3.

Contents : Filtration in the Sugar Industry ; Filtration at different Stations ; Chemical Composition of Filter Deposits ; Amounts of insoluble Substances removed at different Stations; Systems of Filtration in the Sugar Industry; Filtration of Thick-Juice over the Seitz System of Asbestos Filter in the Ungereigen factory (special chapter by Engineer S. KÜHN).

Rats, and how to Exterminate them. Bulletin No. 30 ; formerly Miscellaneous Publication, No. 51 ; Ministry of Agriculture and Fisheries. (H.M. Stationery Office, London). 1931. Price : 6d.

Contents : Rats, Preventive Measures ; some Methods of poisoning Rats and Mice ; Trapping ; Destruction by Fumigation ; Deterrents ; General Suggestions.

Vazcane Process for the Production of Fibre Board from Bagasse. (Vazcane Process, Inc., of 120, Broadway, New York, U.S.A.). 1931. Free on Application.

Contents : The Vazcane Process[2] ; Types of Fibre Board ; Consumption of Fibre Board ; Pressed Board ; History of Vazcane Process ; Description of Process (with photographs and drawings) ; Characteristics of Vazcane Board.

---

[1] *I.S.J.*, 1922, 98. [2] *I.S.J.*, 1929, 645, 1930, 429.

Brevities.

U.S. Beet Crop, 1931.—Willett & Gray estimate the out-turn of the coming domestic beet crop at 1,010,719 long tons, as against a production last season of 1,075,688 tons. Only 65 factories are to operate out of a total of 103 in the United States.

Fiji.—Data on methods of preparing the land, planting, cultivating and harvesting employed by the Colonial Sugar Refining Co. in Fiji are given in an article by F.C.T. Lord,[1] these supplementing Prof. C. Y. Shepherd's notes given a little time ago.[2] This year 87 per cent. of the total area supplying the mills is being cultivated by farmers, 48 per cent. of which are tenants of the C.S.R. Co., and 39 per cent. native land owners. These farmers are nearly all Indians, though Fijians have also begun to enter the industry.

Advertising in Bad Times.—" Mr. Gilbert Hodges, president of the Advertisement Federation of America . . . made a remarkable statement on the success that has attended the efforts of advertisers in America to maintain their business on a profitable basis during the period of depression . . . Incidentally it affords complete justification for the advice tendered to our readers on Janaury 31st, when we said that we were convinced that it was the height of folly to allow established goodwill to depreciate and sales to be lost by a curtailment of expenditure on advertising in times of adversity."—*Times Trade Supplement.*

Five Years of World Consumption.—Willett & Gray calculate the world's consumption of sugar for 1930 at 25,230,319 long tons, a decrease from the previous year of 3·26 per cent. The consumption of the past five years is given as :—

	Tons
1930	25,230,319
1929	26,080,103
1928	24,313,773
1927	22,967,701
1926	25,004,712

" Dry Ice."[3]—This is a trade name for solid carbon dioxide, now an interesting article of commerce in the United States and elsewhere. In the works of Carba Dry Ice (Australia), Ltd., of Richmond, Victoria, it is being made from the flue gases of the coke-fired boiler, which raises the steam required for power purposes, viz., driving compressors and pumps, etc. In a little over two years in which the Carba process has been known, about 45 plants of a total capacity of 250 tons per day have been erected in 27 different countries, and 10 others are on order or under construction. Its possibilities as a means of profitably utilizing the CO_2 produced in distilleries appear worth investigation.

Chainomatic Balances.—It is the manipulation of weights and riders below 0·1 grm. that takes up a large proportion of the total time needed for accurate analytical weighing. When using balances equipped with the " Chainomatic " device, the usual weights are used down to the decigramme. After that the balance is established by means of shortening or lengthening a length of fine chain attached to the beam. Adjustment is made without opening the case, and readings are taken to 0·0001 grm. on one vernier scale. Any possibility of error in reading small weights is thus eliminated ; and the graduations on the scale being white on black are very distinct and easy to read.

Red Lead Paint.—That red lead paint is the best protection against rust and corrosion for iron and steel is well recognized, says a recent circular. It neutralizes the carbon dioxide, sulphur dioxide, and other corrosive gases in the atmosphere. It is resistant to the sun's rays, and to stray electric currents, whilst also being very tough, though elastic enough to expand and contract with the temperature changes of the structure. Reasons are suggested for these properties. It is a distinctly reactive substance. It consists of a definite chemical compound between the lead oxide and the linoleic acid of the linseed oil. Further, it is likely that there is some definite chemical and physical reaction between the lead oxide and the iron, which would explain the tenacity with which this paint adheres.

[1] *Tropical Agriculture*, 1931, 8, No. 8, 199. [2] *Ibid.*, 1930, 7, No. 7, 180.
[3] *Chemical Engineering and Mining Review*, 1931, 48.

Review of Current Technical Literature.[1]

PROBLEMS OF CANE JUICE CLARIFICATION. **R. H. King.**[2] *Ind. & Eng. Chem.*, 1931, **23**, No. 8, 954-965.

This is an excellent review of our present knowledge of the defecation process of clarification, giving also the results of some original observations. Throughout the extreme complexity of the problem of good cane juice clarification is emphasized. Sucrose is destroyed by inversion or decomposition at all temperatures and hydrogen ion concentrations. High temperatures and low h.i.c. result in large losses. The optimum reaction for clarification must be determined for a particular juice, and historical evidence aids only in furnishing a probable liming point. High liming, i.e., above 8·0 *pH*, should be permitted only in exceptional circumstances; while low liming, i.e., below 7·0 *pH*, should be advocated only when the phosphate content of the juice is low. The entire question of high or low liming can be answered by balancing the possible inversion loss by boiling acid juice and the loss due to the introduction of non-sugars and the formation of soluble lime salts. Excess calcium results in a catalytic destruction of invert sugar with an increase in acidity, and the higher the alkalinity the more rapid is the acid formation, the net result being an inferior juice. Experiments showed that the rapid decomposition of pure invert sugar in solution takes place in the presence of calcium salts without heat. Through the formation of acids by high liming, matter previously precipitated is brought back into the juice. The settling rate of limed juice depends on the reaction.

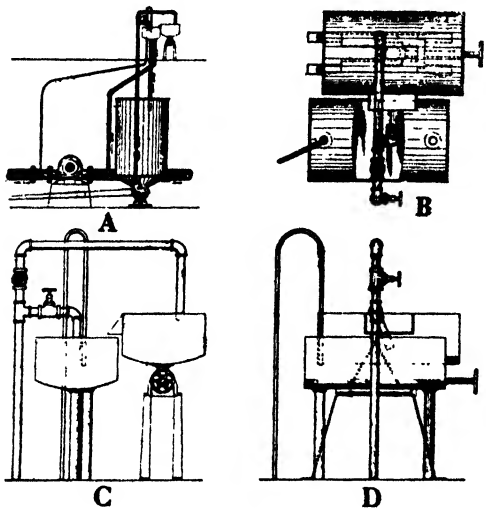
During the time that the juice is maintained at a high temperature at a more or less alkaline reaction in the presence of the coagulated or settled impurities an increase in the h.i.c. occurs, which may amount to as much as 1·1 *pH* or as little as 0·3 *pH*. This indicates the formation of acids, and suggests the re-solution of precipitated matter with the formation of soluble lime salts. Glucose, as is well known, is destroyed by lime and heat. Cane fibre is decomposed in alkaline solution; while colloidal elimination, as given by the dye test, varies from 6 to 35 per cent. Phosphates and silicates are not completely removed with moderate liming, and the amount of silicates generally by far exceeds the phosphates. At as high a *pH* as 10, only 70 per cent. of the silica was removed, while at 8·0 *pH* only 35 per cent. was eliminated. Yet silica removal is important, meaning less scale in the boiling and heating equipment and the better filtration of the raw sugar in the refinery. Sulphates are very soluble. Magnesium removal too is a function of the alkalinity, being greatest at about 9·0 *pH*; while nearly complete precipitation of iron and alumina will occur at 8·0 *pH*, with only about 50 per cent. below 7·0. During the past season a series of comparative factory runs was made to determine the effect of: (1) liming the juice in the cold to 7·8 to 8·0 *pH*, and heating to 104·5°C.; (2) heating to 105°C., and liming the hot juice to 7·6 to 7·8 *pH*; and (3) liming to 6·2 to 6·4 *pH*, heating to 104°C., and liming the heated juice to 7·6 to 7·8 *pH*. Compared with method (1), method (2) resulted in a large increase in the reducing sugar content of the clarified juice. But method (3) using double liming showed an increase in the purity of 2·9 with better clarity, a higher dye value elimination, and an improved sugar filtration rate.

AUTOMATIC CONTINUOUS LIMING. **R. H. King.** *Ind. & Eng. Chem.*, 1931, **23**, No. 8, 956-958.

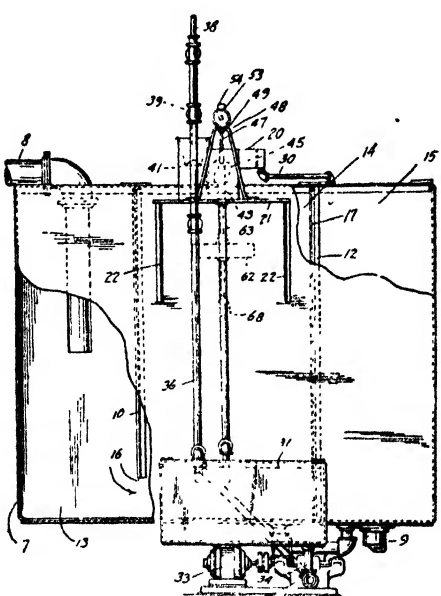
Batch liming usually results in poor clarification, though, the writer adds, under careful control, even though tedious, it can produce excellent results. An advance was made possible by the Fleener lime meter,[3] which, however, must be classed as semi-automatic, as it does not afford continuous liming when the volume of the juice fluctuates. Owing to the use of previously limed juice as a carrier for the great amount of lime to be added, this juice is also greatly over-limed for a short period, causing the development of colour adverse to the production of a good refining sugar. It is not flexible. If the volume of juice being limed fluctuates, and the volume of lime sus-

 [2] Sugar Technology Division, College of Agriculture, Philippines. [3] See also *I.S.J.*, 1924, 91; 1925, 225-226.

pension being added is not changed, the previously determined settling will not give the desired reaction. It consists of two boxes (see figures), one stationary, and the other moveable, the first being divided by a partition. A pipe which connects with the lime-supply tank from one side of this box returns the surplus milk-of-lime. Another pipe carries the lime and the juice discharged from the testing pipe from the liming side of the box into the mixed supply line. The moveable box is mounted on an arrangement which corresponds in principle to the cross-feed of a lathe. By turning a screw, the milk-of-lime overflow is regulated.



On the other hand, the true automatic continuous liming device must combine: (1) automatic addition of a constant amount of available calcium hydroxide per unit of juice; (2) adaptability to change in quality of juice; and (3) immediate change in the amount of lime added when the volume of juice changes. These requirements are met in the Zitkowski lime meter, which was invented at the central of the Pampanga Sugar Development Co., in the Philippines, and successfully operated there during the 1929-30 season. With this apparatus a continuous supply of lime was added according to the rate of flow of the juice and the amount was constantly checked by colorimetric standards. Settling rates were determined, and immediate changes in the amount of lime being added were possible. Once the amount is determined, any fluctuation in the juice flow produces a corresponding variation in the lime flow. The limed juice returned for testing is mixed with the large volume of unlimed juice, so that no overliming is possible. The principal part of the apparatus is the mixing tank 7, which is provided with a sloping conical bottom, so that no juice remains in any compartment. This tank has an inlet 8, and an outlet 9, and is divided into 3 compartments, 13, 14, and 15. Partition 10 is set up from the bottom of the tank, and the chamber 13 is provided with a sloping baffle so that there is no obstacle to the continuous flow of juice through the passage 15, and no juice remains pocketed in the tank. The gradual rise in chamber 14 raises the float 62, which regulates the amount of lime to be added to a given volume of juice. Partition 12 acts as a weir, and has a V-shaped over-flow, 17, whereby juice from compartment



14 flows into chamber 15. The juice and lime mix at this overflow, the volume of juice overflowing over the V-weir determining the volume of lime added. An intimate mixture is obtained. A small portion of the limed juice is returned by the pump to the liming station for testing the reaction. The hot clarified juice is also returned for settling tests at this station, and is returned with the limed mixed juice. The amount of lime to be added is regulated by the adjustment of the sleeve 45, which is directly connected to the float. This regulation prevents a flow of lime into the juice receiving tank after the juice has ceased to flow. A decrease in the overflow through the sleeve raises the level of lime in the overflow tank, and allows a greater quantity of lime solution per unit of juice to flow over the V-weir of the lime box.

MODERN EVAPORATOR DESIGN. **W. L. Badger.** *Chemical and Metallurgical Engineering*, 1931, **38**, 223-225.

Prior to 1923 the horizontal-tube evaporator was built by different makers with a rectangular body, or with the body in the shape of a vertical cylinder, or of a horizontal cylinder. All three types have been used almost since the beginning of multiple-effect evaporation. The cylindrical bodies usually were built of ring castings; the rectangular bodies of flanged flat plates. In 1928 it was noted that the tendency was definitely away from the flat-plate construction and that the vertical cylindrical shell was becoming more important. In the past few years this tendency has been emphasized so that now relatively few rectangular body horizontal-tube evaporators are built. Certain industries, such as the beet sugar industry and the malt syrup industry, are familiar with this design and in some cases still demand it. The Yaryan evaporator has had a rather checkered history, and has never seemed to be properly oriented with respect to the other types.

Vertical-tube evaporators may be roughly separated into two general classes: first the short-tube type; and second, the long-tube high-velocity type. The submerged-tube type of vertical-tube evaporator probably is the best-known and most widely used of all evaporators. It was so thoroughly worked out in the early days of the industry that no important changes have been made in any detail for many years. The second group, namely, the long-tube high-velocity type, has seen marked development in the last few years. The Kestner evaporator as such has never been successful in the United States, in spite of its wide adoption in Europe. The other important development in the line of long-tube high velocity evaporators, viz., the forced circulation evaporator of the Swenson Evaporator Company, was well under way in 1928 (when the writer's last review was made). At present it is in use in almost every caustic-soda plant in the United States. It is also used for the evaporation of paper-pulp liquors, glycerin and soap lyes, common salt, fermentation slop, and petroleum distillate. It is sufficient to say that in the 60 to 70 effects now in operation, all these advantages have been fully brought out in practice. The Lillie evaporator has practically disappeared from the picture. Since 1928 the pressure evaporator has made no more headway in the United States than was apparent in the previous article. In 1923 the writer discussed vapour recompression at length, but came to the conclusion that there are relatively few cases in which it could ever be considered practical.

SOME ASPECTS OF BOILER-WATER CHEMISTRY. **H. E. Jones.** *Journal of the Institute of Chemistry*, 1931, 160-164.

Important investigations have recently been carried out on this subject, and empirical methods are rapidly giving way to scientific means of controlling dense scale formation, and embrittlement. Lime-soda softening can reduce the hardness to 2-4°, but even then sufficient dense scale may form to cause bulging or even rupture of the tubes of modern water-tube boilers. R. E. HALL and others have shown dense adherent scales to consist of calcium sulphate and calcium and magnesium silicates, while sludge usually consists of calcium carbonate and magnesium hydroxide. Dense adherent scales are deposited *in situ*, not by the caking of existing solid matter, and their constituents have negative solubility coefficients, the sludge-forming compounds being positive in this respect. HALL therefore concluded that since the most important scale-forming compound is calcium sulphate, it is necessary to treat the

feed-water in such a way that calcium compounds are deposited as carbonate and not as sulphate. From a knowledge of the solubility products of the two compounds, it is possible to determine the concentration of the $-CO_3$ ion relative to the $-SO_4$ ion necessary to ensure deposition of carbonate. The most convenient and economical method of controlling the $-CO_3$ concentration is by the addition of sodium carbonate. When the feed-water is softened by the lime-soda process, it is necessary in order to achieve the desired result to regulate the excess of soda ash used in the softening in relation to the total sulphate (SO_4) content of the water.

This method of carbonate conditioning also prevents the formation of calcium silicate scale. Although magnesium carbonate is not deposited from boiler-water, sufficient of the sodium carbonate is converted to hydroxide to prevent the formation of adherent magnesium silicate scale, and the magnesium salts are precipitated as hydroxide, a compound of low solubility and positive solubility coefficient. By reason of the conversion of carbonate to hydroxide in the boiler, it follows that it is not sufficient to maintain the critical $-CO_3/-SO_4$ ratio required at a particular pressure in the water entering the boiler. The relative concentrations of CO_3 and SO_4 in the feed-water have to be such that the minimum ratio is maintained in the concentrated boiler-water, i.e., after partial conversion of carbonate to hydroxide, and it is necessary therefore to control the conditioning by means of analytical tests on the blow-down water. The method outlined has proved to be of the greatest value in industrial boiler plants. It is satisfactory, however, only at pressures below 250 lbs. because the increase with pressure in the critical $-CO_3/-SO_4$ ratio, and the greater formation of hydroxide, make difficult the maintenance of the minimum ratio required without giving rise to an excessive caustic alkalinity of the boiler-water. Fortunately a conditioning agent, effective at high pressures, is available in trisodium phosphate, which, used in conjunction with a small proportion of caustic soda, results in the deposition of calcium as phosphate and magnesium as phosphate or hydroxide. There is little doubt that the adoption of these simple methods of conditioning boiler-water by means of carbonate and phosphate greatly improves the efficiency of boiler operation and reduces the risk of serious damage resulting from over-heating of the plates and tubes. Regarding caustic embrittlement, PARR and STAUB concluded that two conditions must be present simultaneously to cause it : (1) the actual stress must be above the region of the yield point of the metal, and (2) the concentration of caustic soda must be in excess of 350 grms. per litre. Sodium sulphate and especially sodium phosphate act as inhibitors. Its prevention is not so difficult as was formerly supposed. It can be controlled by proper methods of conditioning.

ELIMINATION OF FILTER-PRESSES BY FINELY SCREENING THE JUICE AND APPLYING THE MUD TO THE MILLS. **Julio C. González Maíz.** *Proceedings of the Fourth Annual Conference of the Association of Sugar Technologists of Cuba*, 1930.

When very fine sieving equipment of the rotary, shaking and hammer vibrating type, having screens Nos. 80 and 100 (6400 and 10,000 holes per sq. in.), are used, the filtration of the mud becomes impracticable, owing to the absence of the *bagacillo*. But by screening off the fibre in this way, one gets very much less mud, as the following analysis of the press-cake from a mill with revolving knives and modern milling installation shows: Water, 50·68; fibre, 21·65; wax, 4·43; albuminoids, 2·33; sucrose, 6·12; glucose, 0·26; gums, 1·28; phosphate of lime, 4·28; silica, 4·24; sand and clay, 1·27, and undetermined, 3·46, a total of 100·00. This has suggested the idea of applying the small volume of mud obtained to the blanket of crushed cane undergoing milling, an idea which has been put into practice. If possible the mud should be applied to one mill only, and the cloudy liquid extracted by this unit is pumped to the blanket of crushed cane of the preceding mill, which second blanket acts as a second filter, and completes the work of filtration. Naturally the amount of liquid to be extracted by these two units is increased considerably, especially if it is taken into account that the method of compound maceration is not modified, To overcome this difficulty, and at the same time to improve the mill work, attention

should be given to the juice grooving. One groove per inch at 45°, or better at 30°. in the cane rolls, and Messchaerts every 3 in. in the bottoms, is recommended. In spite of the increased volume of the feed, this permits a closer opening, avoiding chokes, and undue wear of shells. By this method, it is claimed, well clarified juices can be obtained and with less colour than by ordinary methods, much less saccharetin having been extracted.

Regarding the sucrose in the mud, by applying it to the mills as described its sucrose content is lowered, using the same amount of saturation water, compared with ordinary filter-press work, the amount of water at the mills being in both cases the same. Using filter-presses, the mud per cent. cane might be 1·58, and the sucrose in the mud, 6·12, giving 0·0967 sucrose loss in mud per cent. cane. Applying the mud to the mills, one might have mud per cent. cane, 1·48 ; and sucrose in the bagasse, 2·25, giving 0·033 sucrose loss per cent. cane, a saving in sucrose loss of 0·097—minus 0·033 or 0·065. When the mud is added to the bagasse, its fuelvalue is increased, due to the higher amount of fibre and sugars present in it ; and it is said that mills using this method have been able to increase the saturation water so as to lower the sucrose in the bagasse to a degree that completely eliminates the mud loss without incurring additional expense for extra fuel. Following is a balance showing savings and costs for this method as compared with ordinary working, which figures are said to be the averages of the four crops from 1927 to 1930 inclusive :—

Repairs, maintenance and operation of filter-press station..	$2,222.62	
Superphosphate for the defecation (1 lb. per 1000 of cane)..		$675.00
Increased yield....................................	2,247.37	
Increased fuel value equivalent to oil	2,164.00	
Cost of fine screens for strainer........................		336.00
Attention to strainer		144.00
Increase in lime necessary, due to use of superphosphate..		98.50
Sacks and freight on increased yield of sugar		274.02
	$6,633.99	1,527.52
NET SAVING..		5,106.47
	$6,633.99	$6,633.99

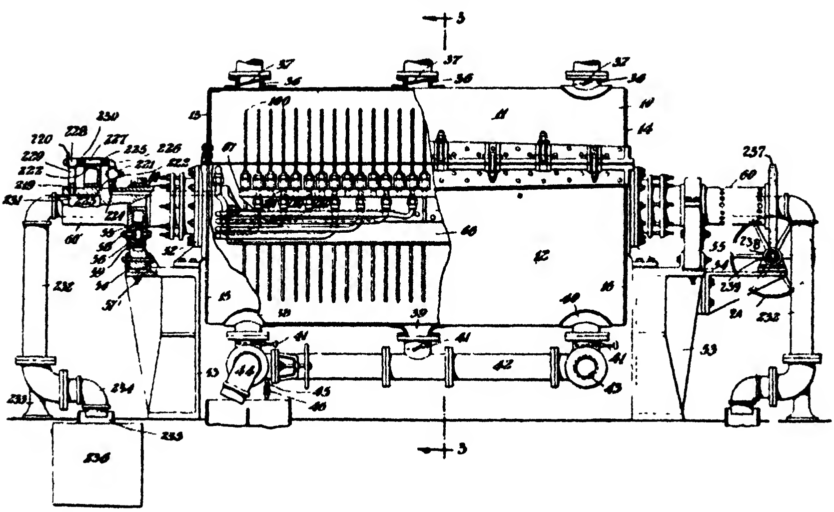
BOILER FEED WATER TESTING. **D. Northall-Laurie.** *The Analyst*, 1931, **61**, No. 665, 526-527. Modern methods of boiler feed-water control require a definite ratio between sulphate and carbonate. The carbonate, that is sodium carbonate, or total alkalinity, is easily determined either by the Winkler method, or by the excess acid method ; but heretofore for the sulphate determination methods depending on the degree of turbidity of the barium sulphate precipitate had been largely used. But the accuracy of such procedures is questionable, as differences in the size of the particles upset the comparisons. Definite advantages are now offered by the new method of the author, which consists in shaking a measured quantity of water with a suspension of barium carbonate, and titrating the sodium carbonate formed. It is claimed to be both simple and accurate, and for details reference should be made to the original paper, or to this Journal.—JAPANESE KIESELGUHR. **T. Tanno and M. Odagiri.** *J. Soc. Chem. Ind., Japan*, 1931, **34**, 157-158*B* ; through *J. Soc. Chem. Ind., London*, 1931, **50**, No. 34, 777*B*. "Japanese-coast diatomaceous earths are similar in properties to the American supercells used for sugar solutions, and if suitably refined are superior to the American refined earths which they may replace for sugar filtration."—DETERMINATION OF PURITY BY CONDUCTIVITY DEPRESSION METHOD. **J. H. Zisch.** *Facts about Sugar*, 1931, **26**, 299-301. This method has been modified,[1] by eliminating part of the manipulation, and now presents the following advantages : Purities may be determined with it almost as quickly as with the Pol./Brix purities, and a large number of samples can be analysed at one time by an untrained assistant ; but the results are almost as dependable as acid-inversion figures, and can be obtained in about one-third of the time. J.P.O.

Review of Recent Patents.[1]

UNITED STATES.

FILTERING APPARATUS ("AUTO" FILTER FOR "SUCHAR"). **John J. Naugle,** of Brooklyn, N.Y. 1,793,289. February 17th, 1931.

Advantages of this rotary type filter are : simple in construction ; easy, safe and convenient to assemble and operate ; renders possible a very high rate of filtration ; convenient control of the discharge of filtrate from the various elements ; ready determination of defective filtering elements, and their prompt replacement, and lastly speedy and thorough cleansing of the machine after a cycle of filtering operations. Its operation may be briefly summarized as follows : Liquor to be filtered such as sugar solutions carrying in suspension therein a filtering agent, such as an activated carbon, viz., "Suchar" the decolorizing medium, enters the machine, particularly the shell 10 comprised of the shell sections 11 and 12, by way of the filter feed inlet pipe 43, the valves 41, which are open, and the filter inlets 38, 39 and 40. As the machine fills up, the pressure of fluid within the same increases, thus all the more firmly seating gaskets preliminarily compressed by the adjustment of the hinges and swing bolts with which the machine is provided. Valves 222, which separately and independently control the discharge of filtrate from each individual filtering element



100, are now operated so as to permit the discharge of filtrate from the interior of most of the filtering elements 100, except two of three filtering elements, which latter are preferably kept shut off during each cycle of filtering operation. There is thus one set, comprising most of the filtering elements 100, which normally acts to discharge filtrate from the interior of such filtering elements by having the respective valves 222 opened. There is thus also another set of filtering elements, comprising a few of such filtering elements, which are preferably distributed equally throughout the entire group of filtering elements 100, which is normally preferably not used during the main cycle of the filtering operation, but is used to empty the machine at the end of such cycle, as will be subsequently described in greater detail.

Shaft sections carrying the filter-element supporting frame which in turn carries the filtering elements 100 and their associated fittings within the shell 10, are now put in rotation by any suitable means, at a comparatively low rate of speed, as 2 to 10, generally about 3 to 5, revs. per min. through the liquor to be filtered, which liquor now fills the shell 10 at a substantial pressure, depending upon the pressure

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom* : Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States* : Commissioner of Patents, Washington, D.C. (price 10 cents each). *France* : L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany* : Patentamt, Berlin, Germany.

with which the filtrate is forced into the shell 10, causes filtrate to pass into the interior of the operative filtering elements 100 in a uniform manner and with a correspondingly uniform deposit of the filtering agent, such as the "Suchar" or other activated vegetable carbon referred to above, upon the filtering surface, comprising the entire surface, of each operative filtering element 100.

Clear filtrate will thus be discharged from the interior of each filtering element 100 through its discharge fitting, through a communicating opening in a manifold, into a longitudinal channel in the shaft section 61, and thus into the external fitting 220 which is valve-controlled and which renders visible a portion at least of the flow of filtrate from each filtering element, thus enabling the discharge of filtrate from each filtering element to be individually controlled by the valve 222 in accordance with the operating conditions, particularly as revealed by the sight-glass or glass tubing 227. During the discharge of the filtrate a constant circulation of liquor to be filtered containing "Suchar" or other carbon takes place from the interior of the shell 10, through the bleeds 36 controlled by the valves 37, into the reservoir of liquor to be filtered, and thence through the filter feed 43 back to the filtering machine. This manipulation of the liquor to be filtered containing in suspension therein the filtering agent referred to, greatly increases the efficiency of such agent and otherwise assists the efficiency of the filtering operation, particularly the rate of flow and purity of the filtrate and the most economical use of the filtering agent itself.

PRODUCTION, APPLICATION AND REVIVIFICATION OF ACTIVATED (DECOLORIZING) CARBON. (*A*) **Wm. M. Williams** (assignor to **Activities, Ltd.**, of Nottingham, Eng.). 1,798,827. March 31st, 1931. (*B*) **Elroy J. Miller**, of East Lansing, Mich. 1,803,943. May 5th, 1931. (*C*) **Ernst Berl**, of Darmstadt, Germany. 1,812,316. June 30th, 1931. (*D*) **R. G. Davis** and **M. T. Sanders** (assignors to **Darco Corporation**, of Wilmington, Delaware. 1,810,871. June 16th, 1931. (*E*) **J. T. Power** (assignor to the **Darco Corporation**, of Wilmington, Del.). 1,815,525. July 21st, 1931. (*F*) **Gerhard Kröner** (assignor to **I. G. Farbenindustrie A.-G.**, of Frankfort-on-the-Main, Germany). 1,815,781. July 21st, 1931.

(*A*) Apparatus for the production of activated carbon consists in a combustion chamber in the form of an elongated furnace of rounded cross section, and means for injecting carbonaceous material thereinto in a tangential direction. (*B*) Commercial grades of activated charcoal are purified by admixture with hydrofluoric acid, removing said acid, boiling with hydrochloric acid, and then removing the last-named acid. (*C*) Acid sludges derived from the treatment of hydrocarbons are treated with neutralizing agents, and the mixture heated to a temperature of approximately 800-1000°C. (*D*) In the activation of carbon, preheating to a temperature approaching but not above 800°C. by contacting it with hot combustion gases containing CO_2, removing the preheated carbon from said contact and then heating the carbon to a higher temperature in an atmosphere of steam substantially free of CO_2. (*E*) Feeding finely divided and dispersed carbon particles continuously into the top of an upwardly flowing column of hot gases containing CO_2 and H_2O, said gases being preheated to a temperature substantially above 900°C. and so adjusting the rate of flow of the gases and the rate of feed of the carbon in correlation with the height of the column and the pre-heat of the gases as to afford time for complete activation and removing the activated carbon from the bottom of said gas column. (*F*) Carbon is produced by decomposing carbon monoxide by means of a catalyst, composed of at least one metal of the eighth group of the periodic system in a finely divided and carefully reduced form and at least one difficultly reducible metal oxide of the group consisting of magnesium oxide, aluminium oxide and calcium oxide, at a temperature between about 250 and 450°C.

CANE CUTTER. Wm. H. Morgan (Morgan Hurrycane Co., of New York). 1,785,743. December 23rd, 1930. An apparatus is described (supposed to follow a harvester) for cutting cane stalks into short lengths and separating the trash therefrom. It comprises the combination of a frame, a hopper on this frame, stalk cutting appliances within the hopper, means for delivering the stalks to the cutter, a rear end conveyor,

a trash guiding device at the rear of the rear end of said conveyor and a blower adapted to discharge an air blast between the discharge end of the rear conveyor and the trash guiding device.—HAND CANE CUTTER. **Karl A. Behne,** of San Juan, Porto Rico. 1,802,307. April 21st, 1931. This is an electrically-operated cane-cutting device adapted to be carried by the operator, having approximately the shape of a large pistol. It is designed to have few moving parts, to be efficient in operation, light in weight, positive in its cutting action, and easy and cheap to manufacture. It operates with a stroke of 3 in. of the cutting member under a force of from 5 to 6 lbs. One of its claims reads : " A sugar cane-cutter comprising a barrel, a housing at one end thereof, a handle on said housing, a guide portion on the other end of said barrel, a reciprocal cutting member in said guide portion, a connecting rod in said barrel pivotally secured at one end thereof to said cutting member and electrically-operated means in said housing and connected to said rod for actuating said cutting member, said cutting member comprising a cylindrical portion and a blade attached to said cylindrical portion, and a pair of laterally extending fingers on the outer end of said guide portion.—CANE HARVESTING APPARATUS. **Arthur C. Howard,** of Northmead, N.S.W. 1,808,113. June 2nd, 1931. Cane harvesting apparatus comprises a wheeled structure provided with power drive and with steering means and also with means whereby cane stalks can be gathered and cut and firmly gripped at their butt ends by conveyor means and conveyed thereby in upstanding position rearwardly of the apparatus, fender means associated with the structure and below which such conveyor means passes, and an abutment on the structure in the path of such conveyor means adapted to allow bending of the upstanding cane stalks carried by such conveyor means to enable such stalks to be fed by such conveyor means in butt first position thereof to mechanism on the apparatus for further treatment.—CONTROLLING THE APPLICATION OF RE-AGENTS TO SOLUTIONS. **Walton C. Graham** (assignor to **Gilchrist & Co.**). 1,808,546. June 2nd, 1931. A method is described of treating a liquid with a reagent comprising recirculating a body of the liquid continuously, adding fresh liquid to and withdrawing treated liquid from said body continuously, spraying the reagent continuously on to a large surface of said body always at the same points in the cycle or recirculation, continuously segregating average samples of the liquid under treatment and conducting them past a point of observation and returning them thereafter to the main body of the liquid, continuously pumping a quantity of reagent from a reagent source and spraying a portion of it on to said surface, regulating the pressure of the reagent between the pump and the spray and hence varying the amount sprayed by varying a restricted return flow of the reagent from the delivery side of the pump back to said source, the amount of said pressure being varied in accordance with a characteristic of the liquid flowing past said point of observation and simultaneously maintaining the speed of recirculation of the main body of juice to aid the upbuilding of the flocs and prevent deflocculation by too rapid agitation.—TREATMENT OF RAW SUGAR BEFORE REFINING. **Julien Bergé** (assignor to the **Raffinerie Tirlemontoise,** Belgium). 1,809,807. June 9th, 1931. The process of reducing the sugar content of syrup adhering to sugar crystals in raw sugars, and after-products, comprising placing the said sugar in a storage chamber, and regulating the temperature and moisture content of the air in said chamber to reduce the sugar content of the syrup by crystallization, and then freeing the sugar from the largest portion of the adhering syrup in a centrifuge exerting a particularly high centrifugal force.—DE-SUGARING SYRUPS AND MOLASSES. **Julien Bergé** (assignor to the **Raffinerie Tirlemontoise,** Belgium). (*A*) 1,809,808; (*B*) 1,809,809. June 9th, 1931. (*A*) A method of de-sugaring sugar solutions comprises covering the surfaces of sugar crystals with thin layers of the solution, the quantity of crystals being sufficient to make the mass of a consistency similar to raw sugar, and aiding the de-sugaring of the solution by cooling and by evaporation. (*B*) A method for crystallizing sugar from solutions, comprises admixing sugar crystals with massecuite to form a mass having a relatively large quantity of sugar crystals comprising about 85 per cent. of the mass and a relatively small quantity of syrup comprising about 15 per cent. of the mass so that the syrup is widely distributed over the surfaces of the sugar crystals and substantially all of the syrup is brought into close and intimate contact with the sugar crystals, and then cooling the mass.

Beet Crops of Europe.

F. O. Licht's Fifth Estimate at August 31st 1931.

	1931-32. Hectares.		1930-31. Hectares.		1929-30. Hectares.
Germany	360,000	..	468,293	..	433,900
Czecho-Slovakia	190,000	..	237,038	..	227,258
Austria	42,000	..	35,610	..	29,687
Hungary	58,000	..	65,653	..	72,975
France	228,000	..	259,210	..	244,867
Belgium	50,000	..	51,839	..	57,194
Holland	37,000	..	57,462	..	55,002
Denmark	29,000	..	32,000	..	29,900
Sweden	33,000	..	36,731	..	27,449
Poland	160,000	..	179,912	..	242,040
Italy	107,000	..	113,700	..	116,111
Great Britain	94,000	..	138,903	..	92,221
Other Countries	191,500	..	234,591	..	225,080
Europe without Russia	1,579,500	..	1,910,942	..	1,853,684
Russia	1,406,000	..	1,044,000	..	784,000
Europe including Russia	2,985,500	..	2,954,942	..	2,637,684

United States Atlantic Ports.

(*Willett & Gray*).

(Total of 2,240 lbs.)	1931 Tons.		1930 Tons.
Total Receipts, Jan. 1st to August 22nd	1,728,935	..	1,663,027
Deliveries „ „ „	1,754,520	..	1,945,605
Meltings by Refiners „ „	1,679,722	..	1,946,158
Exports of Refined „ „	29,000	..	33,000
Importers' Stocks, August 22nd	133,307	..	154,693
Total Stocks, „	293,881	..	313,734
	1930		1929
Total Consumption for twelve months	5,599,377	..	5,810,980

Cuba.

Receipts, Exports and Stock at August 22nd.

(*Willett & Gray*).

	1931 Tons.		1930 Tons.
Production to date	3,122,186	..	4,671,260
Less Cuban Consumption to date	95,000	..	80,000
	3,027,186	..	4,591,260
Stock at Shipping Ports	764,505	..	1,292,801
Total Exports	942,844	..	1,810,698
Total Receipts at Shipping Ports	1,707,349	..	3.103,499
Stock on Plantations and in transit to Ports	1,319,837	..	1,487,761
Total Sugar in Cuba (partly estimated)	2,620,677	..	2,780,562

United Kingdom Monthly Sugar Report.

Our last report was dated 10th August, 1931.

During the past month, although the position of sugar statistically under the Chadbourne plan remains the same, the general world financial position has created an unsettled feeling in most articles, and sugar has suffered in common with others. In consequence there has been a general decline in price.

Germany was most anxious to export sugar in order to rectify her trade balance and lower prices had to be accepted. These sales were followed by Java who, probably having fears of Russia and Cuba, suddenly came out as a seller, and placed about 400,000 tons. The sentimental effect of these sales, coupled with the necessary hedging operations on the Terminal Markets of the world, brought about this general decline.

The London Terminal Market had its share of selling and prices fell rather rapidly in the latter half of August, which month sold down from 6s. 2½d. to 5s. 7½d.; December sold from 6s. 6½d. to 5s. 6¾d., to 5s. 9½d.; March sold from 6s. 9½d. to 5s. 10d. to 6s. 0½d.; May from 6s. 11½d. to 5s. 11¾d. to 6s. 2½d.; and August from 7s. 2d. to 6s. 2d. to 6s. 4½d.

Trading in refined sugar has been disappointing, and generally speaking it has been very quiet. The British Refiners made three reductions of 3d. on the 19th and 23rd August and 3rd September, their latest prices being No. 1 Cubes 23s. 3d. and London Granulated 19s. 7½d. The demand during the past week has been slightly better in anticipation of a possible increase in the sugar duty.

The American Market has also been easier and the price of Cubans has fallen from 1·50 to 1·38, although recently 1·40 has been paid again.

F. O. Licht reports weather conditions favourable for the growing European beet crop. D. Mikusch has issued a preliminary estimate of the growing crop as follows, excluding Russia 6,447,000 tons against 8,611,000 tons last year. Russia however he estimates at 2,700,000 tons against 2,000,000 tons last year.

21, Mincing Lane.
London, E.C.3.
9th September, 1931.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 394. OCTOBER, 1931. Vol. XXXIII.

Notes and Comments.

The Political Crisis in the United Kingdom.

We went to press last month just prior to the introduction by the newly formed National Government of a supplementary Budget and an Economy Bill destined to correct the adverse balance in our national finances. Mr. SNOWDEN produced a measure based on existing modes of taxation, and designed to spread the burden as evenly as possible. There was no time to risk in striking out a new line that might have been contentious, so even had he been a much less staunch free trader he was possibly justified in avoiding for the time being anything approaching a tariff. The only relevant criticism that was made was to the effect that he might have renewed the tax on tea and touched up that on sugar. As it was, sugar remained unaffected. As for the Economies Bill, this made a cut of 10 to 20 per cent. in State salaries and wages (Government, Civil Service, Education, Navy and Army, and the like) and in the "dole," on the grounds that the State could not afford to continue paying on the old scale. Both measures have been passed in the minimum time of a month, the parties to the National government having no difficulty in securing a steady majority.

This balancing of the financial situation had a temporary good effect on the run on the £, and it was hoped that the danger had been averted. Unfortunately foreign opinion was dubious as to the strength of the National party in the country, and certain manifestations of popular discontent at wage reductions in the State service—in particular an outbreak of passive resistance in a section of the Navy, which was grossly exaggerated by the world press—further alarmed foreign investors in British funds and there was a steady drain of gold from the Bank of England overseas during the middle of September which was in danger of exhausting the gold reserves of the Bank. To save the situation the Government had to agree on September 21st to come off the Gold Standard. This caused a drop in the value of the £ fluctuating between 20 and 25 per cent.; but there has been no panic, and the country has discovered that its export trade has for the time being secured a distinct advantage.

When the National Government came into being it was assumed that they would merely balance the financial situation, and then dissolve and allow party Government to resume sway. But with every day of the crisis it

was made clearer that the task could not be completed in a matter of months, but that it was imperative for the country to have a combined Government of the leading anti-Socialistic parties till the economic stability of the country was assured. For the last three weeks controversy has raged as to whether the National Government should go to the country for a fresh mandate and so secure a long lease of life. Conservatives urged it, Liberals were against it, but the consensus of opinion was that it was better to take the risk at once than to go through a period of prolonged uncertainty and with no really adequate majority in Parliament for any measure in the least degree controversial, for instance the question of tariffs. As we write, it has been finally decided to have a General Election before October is out and though there has been a great deal of negotiation (not to say wrangling) amongst the parties to the new National pact as to whether tariffs were to be a live issue or not, the Prime Minister, Mr. MACDONALD, has succeeded in securing agreement to an open mandate which, while it will probably satisfy neither the extreme protectionists nor the unrepentant free traders, will ensure that a tariff is given a trial in certain branches of trade and if the results justify it, it can be extended to others. We write this before seeing the manifestos of the party leaders subscribing to the National Government, so it is a matter of conjecture to what degree there will be mutual emphasis on points of policy; but we shall be surprised if there is not a strong majority, not confined to the Conservatives, in favour of an extension of Imperial Preference, in which British Dominions and Colonial sugar should stand to benefit. However, the first thing is to await the result of the General Election.

If the country decides wrongly, it may stultify all chances of economic recovery for a generation; but we take leave to believe that the country as a whole will give its confidence in no uncertain measure to the National party. At the same time it is recognized that the increased taxation *plus* the reduction in State-paid wages will lead to a certain amount of resentment. On the other hand, the only alternative party is the dissenting Labour Party, largely ruled by the trade unions, who favour a policy of "social" reform that their own ex-Finance Minister, Mr. SNOWDEN, has calculated will cost the country an extra thousand millions in taxation. It is urged with convincing logic that it is better to take the verdict of the country now when the crisis is evident, than carry on till it is forgotten or its existence denied, and a possible rise in the cost of food owing to the fall in sterling provides the malcontents with a popular election cry.

If the National Government is returned with an adequate majority composed of those Conservatives, Liberals and Labour men who put their country before their party, the way will be opened for restoring the fortunes of the United Kingdom, and it should lead also to International negotiations that may help to oil the clogged wheels of world trade. Any measures, fiscal or economic, that will break up the present *impasse* in world industry are greatly to be desired, not least being the question whether the gold standard is to be restored or finally abandoned in favour of some more workable system.

The Sugar Crop Outlook.

The sugar market during the past month may be said to have marked time. There has been no pressure to sell anywhere, but prices are under the influence of the upheaval in the monetary exchanges resulting from Great Britain and the Scandinavian countries going off the Gold Standard. Slow as the effects of the Chadbourne agreement are in present abnormal circum-

stances, there is nothing to suggest that they are not working according to plan. LICHT points out, for example, that but for the voluntary restriction of European beet a new bumper sugar production would have been a certainty in Europe. Actually, as we indicate below, there is a pronounced reduction of really surprising dimensions. The one danger to the Chadbourne scheme can only arise from a further demoralization of money values forcing the countries involved to realize all their assets, including their stores of sugar. That danger is not yet, and it is to be hoped will never be reached.

F. O. LICHT came out at the end of September with his first estimate of sugar production in the European beet field. For Europe without Russia his figure is 6,171,000 metric tons, which is distinctly lower than MIKUSCH'S August estimate of 6,447,000 tons. As for Russia, he takes the Russian official pronouncements made public in September that their crop promised to yield 20 to 25 per cent. less sugar per hectare, as compared with last year. As a consequence the somewhat confident estimate made only a few weeks earlier by the same Russian authorities of 2,700,000 tons has to be considerably reduced. On the basis of only 20 per cent. reduction, LICHT puts the crop as probably 2,150,000 tons. Taking these figures he accordingly arrives at a *reduction* of the sugar production of: Europe without Russia by 2,460,150 tons or 28·5 per cent.; Europe including Russia by 2,320,300 tons or 21·8 per cent. The large decrease thus indicated in Western Europe is mainly due to the restriction in sowings. The weather—none too favourable—has not been an appreciable factor, for LICHT comments on the "very surprising fact" that two years running can bring an extremely good beet crop. But the strength would appear to lie more in the weights of the roots, as the sugar content in many countries lacks satisfaction. The weather of October may or may not remedy this.

An indicated drop of 21·8 per cent. in the European sugar crop in normal times would have had an instantaneous effect on sugar prices, for a reduction of over two million tons of sugar will more than wipe out the increase of world visible stocks between September 1st, 1930 and August 31st, 1931, and reduce them to little more than the figure of September, 1929. But in the abnormal state of markets the effects must be left to leaven in. A few months hence the results may be more evident.

Mr. CHADBOURNE has lately reminded the sugar market that the International Sugar Council does not allow its parties to accumulate additional surplus stocks. In the case of Cuba, President MACHADO has already issued a decree indicating that the quota which Cuba shall reserve from her 1932 production for export to the U.S.A. shall be reduced by the same quantity by which Cuba has remained in arrears in her exports to the U.S.A. during 1931. Thus no sugar can be carried over without reducing the 1932 crop nor will it be assumed in fixing that crop that such surplus will be consumed next year.

The International Sugar Council.

The International Sugar Council held its second meeting at the Ritz Hotel, Paris, on 14-15th, September, 1931, Senator BEAUDUIN of the Belgian Delegation being in the Chair. There was a full representation of the Cuban, Javan, Czechoslovak, German, Polish, Hungarian and Belgian Associations.

The Council proceeded to elect the Members of the Board of Arbitration provided for in Article VIII of the International Agreement of 9th May, 1931. The names of these arbitrators will be announced when they have signified

their willingness to serve. The admission of other countries was also discussed but no decision was taken

The quantities of sugar which Germany was entitled to export under the Agreement were not entirely exhausted. The amount of the deficiency has now been ascertained to be 85,625 metric tons. Under Article VI of the Agreement this has to be divided as follows: Cuba, 65,646 metric tons; Czechoslovakia, 10,960 tons; Poland 6,393 tons; Hungary, 1941 tons; and Belgium 685 tons. These countries have been allowed until the end of their second quota year (in the case of Cuba till the end of 1932) in which to make these extra deliveries. The next meeting of the Council is to be held on December 14th, 1931, at Paris.

F. O. LICHT quotes further information of an unofficial nature as to the deliberations at the last meeting of the Council. Negotiations with Russia are being undertaken, and though so far the Russian offers are not acceptable to the Council, there is every indication that Russia is willing to go on working for the consolidation of the world sugar market. Mr. POWELL has accordingly been charged to continue his negotiations to that end. As a condition of joining, Peru has demanded a five-years' export contingent of 1,850,000 tons (360,000 tons in the first year, 370,000 tons in the second and third, and 380,000 tons in the last two years); and it is stated that the Sugar Council has decided to contract a separate agreement under those conditions; this is hoped to be completed before the next meeting in December. With Santo Domingo negotiations have so far produced no agreement. An attempt is being made to bring France and Rumania within the pact. In New York, Mr. GUTIERREZ, the Cuban representative, is reported to have stated that Russia was decidedly in favour of the Chadbourne plan.

The Sugar Industry in Canada.

A report by the Canadian Government on the sugar refining industry of the Dominion for 1930 shows an increase in the output of refined sugar, although, owing to falling prices, the value of the products was less than in 1929. The quantity of refined granulated sugar produced in Canadian refineries in 1930 was greater than that of 1929 by 2790 short tons, while the quantity of beet sugar increased by 12,612 tons.

The total production of sugar in 1930 was 471,429 tons; 25,406 tons were imported and 10,907 tons exported, so the sugar available for consumption amounted to 485,927 tons. Of the production, 373,831 tons were granulated sugars made from cane, while 47,312 tons were granulated beet; in addition 50,285 tons of soft cane sugars were made.

Last year saw an increased production in the beet sugar industry in the Dominion. The acreage to beets was 40,532, the highest previous figure having been 34,803 acres in 1925. The yield last year was 397,576 tons of roots, as compared with 370,047 tons in 1925. The production of beetroot sugar in 1930 reached 47,312 tons, which compares with a previous highest of 44,640 tons in 1920. The Canadian sugar industry now includes eight plants, of which three are situated in the beet areas of Chatham and Wallaceburg in Ontario, and at Raymond in Alberta.

The gross value of the products of the Canadian sugar refining industry in 1930 was $42,935,722, of which nearly 38 millions was in respect to granulated sugar (cane 33½ millions and beet 4½ millions). The consumption per head in 1930 averaged 97·83 lbs., as against 96·46 lbs. in 1929.

Natal's Premier Sugar Company.

The Annual Report of Sir J. L. Hulett & Sons Ltd. of Durban, the leading Natal sugar producers, for the year ending April 30th last shows that the Company made a net profit of £59,652, which with the previous balance of £16,824 makes a total of £76,476. After paying preference dividends, litigation costs and putting £4000 to income tax reserve, the balance of £54,366 is being carried forward.

The total crop of sugar manufactured at the Company's mills during the 1930-31 season was 102,270 tons, or 24,300 tons more than for the previous year, and constituted a record. The mills worked efficiently throughout the season and favourable weather conditions permitted the harvesting to be carried on uninterruptedly, with the result that the entire crop was milled by the first week in January. The sucrose content was generally good, though it experienced a sharp fall in December. On the whole the season was a good one from the producer's standpoint and with even a very moderate price for its product the Company would have enjoyed a successful year. The net return per ton of 96° cargo sugar was £11. 3s. 8d., the lowest ever received by the Company, and comparing with £16. 2s. 0d. in 1927-28. It was thus only due to the very large crop and the favourable working conditions, assisted by rigid economy, that the Company was able to combat the effect of this extraordinarily low price. The entire output was the work of three large mills, Darnell, Amatikulu and Felixton, Tinley Manor mill not having worked.

Unfortunately the outlook for the 1931-32 season is not bright. The estimated average price for 96° centrifugal sugar indicates a decrease of approximately 16s. per ton, being only £10. 7s. 0d. As this lower price synchronizes with a smaller output, estimated at about 80,000 tons, the prospects for the current year promise to be less satisfactory. The decrease in output is due to a prolonged drought followed by frost which severely affected the cane crops in the low-lying area.

The British Beet Sugar Industry.

Official Report and Statistics for the 1930 Season.

The Ministry of Agriculture in their "Agricultural Statistics for 1930, Part I" give particulars of the 1930-31 sugar beet season in the United Kingdom, of which the following is an abridgment.

The area under beets during 1930, 347,257 acres, showed a remarkable increase over 1929 (the previous highest year) of 117,339 acres, or 51 per cent. Four counties—Lincolnshire, Norfolk, Suffolk and Isle of Ely—grew between them 219,703 acres, or 63 per cent. of the total area planted.

The rise in the beet area in 1930 is to be attributed in part to the good results obtained in 1929, but an important factor also was, no doubt, the poor prices generally realizable for other crops. The number of growers increased from 32,000 in the previous year to 40,000, of whom some 7800 grew more than 10 acres each. No new factories were erected in the year, although the majority increased their beet-slicing capacity to cope with the excess acreage. As the experimental factory at Eynsham did not operate in 1930-31, the number of factories in England and Wales was reduced to 17.

The following table shows the total quantity of beets received at the factories in 1930-31 as compared with those for 1929-30 :—

	Factory.	Washed and topped beet delivered to factory.* 1929-30.		Washed and topped beet delivered to factory.* 1930-31.		Rated beet slicing capacity per campaign of 100 days.
1.	Allscott	114,104	..	140,909	..	85,000
2.	Bardney	99,493	..	166,153	..	100,000
3.	Brigg	64,122	..	122,361	..	70,000
4.	Bury St. Edmunds	208,810	..	324,529	..	200,000
5.	Cantley	229,330	..	310,492	..	250,000
6.	Colwick	92,741	..	129,966	..	120,000
7.	Ely	251,672	..	300,068	..	250,000
8.	Felstead	75,872	..	149,440	..	120,000
9.	Ipswich	126,154	..	172,678	..	145,000
10.	Kelham	55,913	..	96,394	..	100,000
11.	Kidderminster	94,561	..	130,817	..	120,000
12.	King's Lynn	137,420	..	184,358	..	120,000
13.	Peterborough	114,024	..	256,454	..	180,000
14.	Poppleton	54,053	..	123,653	..	120,000
15.	Selby	87,613	..	113,458	..	100,000
16.	Spalding	90,275	..	149,995	..	120,000
17.	Wissington	84,412	..	117,743	..	100,000
18.	Eynsham	18,956	..	—	..	—
	Total	1,999,525	..	2,989,468	..	2,300,000
	Beets grown in England but delivered to Cupar in Scotland	—	..	59,859	..	—
	Grand Total	1,999,525	..	3,049,327	..	2,300,000

The average yield per acre in 1930 of 8·8 tons was the highest yet realized in this country, comparing with 8·7 tons in 1929, the previous best, and 7·7 tons in 1928. Alternatively, however, the sugar content was disappointing, the average of 16·74 per cent. being nearly 1 per cent. lower than that of the previous year's average of 17·69 per cent. and also inferior to the 1928 figure of 17·38 per cent. The reduced sugar content was reflected in the lower beet prices which ranged from 45s. 11d. to 52s. 6d. a ton and averaged 49s. 10d. as against 52s. 11d. and 51s. 11d. respectively in the two previous years.

The weather in 1930 was not, generally speaking, favourable to the crop. Excessive rainfall prevented the preparation of satisfactory seed-beds, while the cold and wet conditions at seeding-time besides delaying this operation, also retarded germination and growth in the early stages, and thus opened up the crop to attacks from disease and pests. During the early part of the growing season conditions were good, but from the middle of June onwards rain fell almost incessantly in most districts and much damage was caused by thunderstorms. As a result of the unfavourable weather, the crop, except on the high lands and lighter types of soil, which had benefited rather than otherwise from the heavy rainfall, was in a very backward state when harvesting commenced in late September. The sugar content was noticeably poor, the first weeks' deliveries averaging 15·6 per cent. only, whereas the corresponding figure for 1929 was 18·9 per cent. The tendency is, in a normal year, for the early deliveries to have the highest sugar content which gradually diminishes as the season advances. In 1930, however, the reverse happened. The dual combination of bright days and cool nights during October caused the content to rise rapidly and the peak was not reached until the beginning of November or two months later than the normal. The abnormality of the 1930 season was

* These figures do not in all cases represent the actual quantities of beets sliced owing to inter-factory transfers.

also reflected in the weight of the roots, which did not, as is usual, gain in weight with the advance of the season.

During the harvesting period conditions at first were good, but later excessive rain interfered considerably with the lifting operations and added materially to the dirt tare which averaged 14·8 lb. per cwt. of beet over the whole season, as against 13·4 lb. in 1929 and 14·5 lb. in 1928.

Another unusual feature of the 1930 season was the length of the manufacturing campaign, occasioned by the heavy supplies of beet, which lasted on the average 115 days, as compared with 91 days and 74 days respectively in 1929 and 1928. Clamping was resorted to on an unusually large scale in 1930, upwards of 35,000 tons being conserved for one factory alone by this means, and where it was carried out by arrangement a bonus of 2s. 6d. per ton was paid to the grower. It was generally reported that roots when stored in good condition and in suitable clamps showed very little loss either in weight or sugar content when the clamps were opened up, and that this method is to be much preferred to that of leaving the crop in the ground for an undue period. Roots harvested in December and later invariably returned a very low sugar content and very high dirt tares. Additional labour costs were also involved in lifting and carting from wet or frozen soil.

The return of manufactured sugar per acre of beet grown, 2724 lb., while being about 1 cwt. per acre less than in 1929 by reason of the reduction of 1 per cent. in the sugar content, was better than might reasonably have been expected. This may be attributed in part to the improvement in factory technique and also to the purity of the beet which was about the same as for the two previous years, viz., 88 per cent. The following table shows the yield of commercial sugar per acre since the inception of the subsidy :—

Season.	Acres.	No. of Factories.	Production of Sugar. cwt.	Production of Commercial Sugar per acre of beet grown. lb.
1924-25	22,441	3	478,308	2,387
1925-26	54,740	8	1,032,759	2,113
1926-27	125,814	12	3,003,933	2,674
1927-28	222,566	17	3,651,620	1,878
1928-29	175,734	18	3,874,664	2,469
1929-30	229,918	18	5,830,018	2,837
1930-31	347,257	17	8,454,574	2,724

The total amount of dried pulp produced by the factories was 193,841 tons, of which 116,269 tons was plain and 77,572 tons molassed. 9 per cent. of the dried pulp was exported. The production of wet pulp was 63,695 tons.

It is reported that the steady improvement in cultivation methods noted in previous years was maintained in 1930. Greater care was exercised in the general treatment of the beet crop, more especially as regards earlier sowing and timely singling, suitable manuring and the selection of the type of seed best suited to local soil conditions. Labour was plentiful, and better organized, and is approaching that high degree of skill necessary to successful beet growing.

On the whole, the 1930 beet growing season, while being somewhat disappointing owing to adverse climatic conditions, gave results which, but for the general all-round improvement in the handling of the crop, could not have been attained a few years ago under similar conditions. It is being realised more and more that beet should be harvested when it is ripe, and if the factory cannot take immediate delivery it is preferable to store the roots in clamps rather than leave them in the ground.

The Reduction of Cane Milling Results to a Common Denominator.

By NOËL DEERR

In the control of a group of factories, or in the comparison of results as between one country and another, the problem of the reduction of results to a common denominator occurs. If results be compared on extraction alone, by which term is understood the proportion of juice extracted, comparison is invalidated by variation in the fibre of the cane milled, by the quantity of water used in the imbibition process and by the number of units in the milling train. It is the present object of the writer to put forward a scheme whereby the effect of these variables may be eliminated.

In the notation used the symbols employed have the following significance :—

Fibre per unit cane $= f$; fibre per unit bagasse $= m$; added water per unit cane $= w$: added water per unit fibre $= w/f = k$; constant factor of extraction in each unit of the imbibition train per unit of material presented to a mill $= r$; total extraction in the imbibition train per unit of material presented to the train $= R$.

If $s = r/1 - r$ I have shown that :—

$$R_n = (s + s + \ . \ . \ . \ + s^n)/(1 + s + s + \ . \ . \ . \ + s^n)$$

where n is the number of mills in the imbibition train.

As the scheme which I propose rests essentially upon this expression as basis, I give in Table I values of R for $n = 1$ to 5 and for values of s from 0·20 to 3·00 by increments of 0·05, whence intermediate values may be obtained by interpolation correct to three significant figures.

With the use of this expression I propose to show how results of record may be analysed with removal of the effect of the variables of operation.

The process of the extraction of juice from the cane by milling divides itself into two operations : The dry crushing in which juice is expressed direct from the material, and which I call the primary process ; and the imbibition or secondary process in which additional juice is obtained following on the application of diluents.

It is patent that the combined extraction due to the two processes may be obtained in an infinite number of combinations of the two processes and the first step in the scheme now put forward is to divide the combined extraction into its components on an arbitrary basis. The basis I have selected is to give to m the constant value of 0·5 and to postulate an ideal cane in which the juice is of uniform composition. Thus, an extraction of 92 per cent. obtained from a cane of 15 per cent. fibre may be split up thus :—

Primary extraction $= e_p = (0{\cdot}5 - 0{\cdot}15)/0{\cdot}5(1 - 0{\cdot}15) = 0{\cdot}8235$.

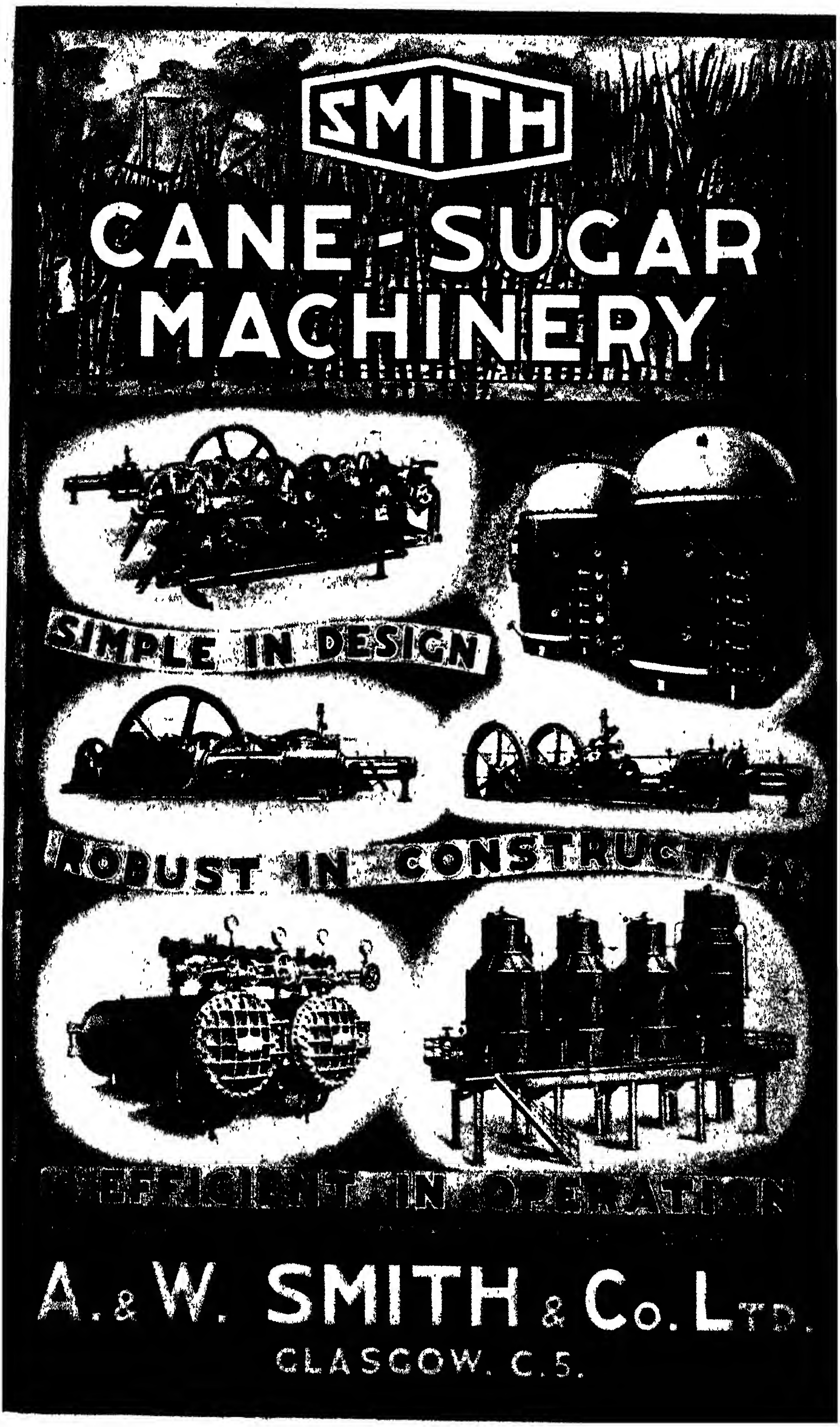
Secondary extraction $= e_s = 1 - e_p = 1 - 0{\cdot}8235 = 0{\cdot}1765$.

As the value of $e_p = (m - f)/m(1 - f)$ is required in all reductions, I have tabulated, and give in Table II, values of this expression for $f = 0{\cdot}100$ to $0{\cdot}180$ by increments of 0·001 and for a constant value of $m = 0{\cdot}5$.

The complete method by means of which I propose to reduce milling results to a common standard of comparison is given below :—

(1) Analyse the observed extraction into its primary and secondary components as for an ideal cane, for a value of $m = 0{\cdot}5$ and with complete admixture of the diluents. Let e_p and e_s be the primary and secondary extractions so found.

(2) Obtain the virtual secondary extraction $e_a - e_p$, where e_a is the actual observed extraction.


SMITH
CANE-SUGAR MACHINERY
SIMPLE IN DESIGN
ROBUST IN CONSTRUCTION
EFFICIENT IN OPERATION
A. & W. SMITH & Co. Ltd.
GLASGOW. C.5.

(3) Obtain the virtual loss in the primary extraction, namely the value of $1 - e_p$.

(4) Obtain R_v the virtual value of R, i.e., the value of the ratio $(e_a - e_p)/(1 - e_p)$, for the value of n in the plant under analysis.

(5) From R_v obtain the corresponding virtual value of r or r_v using Table I.

(6) Obtain the ideal value of r, or r_i for the value of $w/f = k$ as of record for the plant under analysis and determine the value of the ratio $r_v/r_i = a$.

(7) For that condition which may have been selected as standard and to which it may be desired to reduce results of record obtain the value of ar_i.

(8) Obtain the value of R corresponding to ar_i for the value of n accepted as standard, whence may be calculated the corresponding combined extraction $e = e_p + (1 - e_p) R = e_r$.

This value I proposed to term "extraction reduced to standard conditions of operation" or, briefly, the "reduced extraction."

Before proceeding further to demonstrate arithmetically the proposed method of reduction, it is necessary to select arbitrary standards for f, $w/f = k$, and n. For the fibre, f, I have selected the value 0·125 which is typical of the noble canes grown in Hawaii, Java and elsewhere in the tropics.

For n I have selected the value 3 and justify this choice since in Java and Hawaii the majority of the milling trains have three imbibition units. In this method of expression of results the composition of the primary unit, e.g., three-roller, five-roller or crushing plant operating in combination with knives or shredders, is a matter of indifference, if the primary unit is regarded as all the plant before the addition of diluents begins.

The choice of a value of $w/f = k$ is a matter of more difficulty. In Java k is generally about 1·5 and in Hawaii about 2·5 and this latter value, making $w = 0·3125$, has been chosen since I believe that it is in Hawaii that the art of milling cane has reached the greatest development.

With reference to these arbitrary standards I propose to work out the reduction of a milling result to a common denominator.

An 11-roller plant, the first five rollers of which are regarded as the primary unit and the last six as the secondary unit, $n = 2$, operating on cane with 15 per cent. fibre, $f = 0·15$, and with added water 25 per cent. on cane, $w/f = k = 1·67$, has given an extraction of 92 per cent., $e_a = 0·92$.

(1) It is required to reduce this result to a basis of $f = 0·125$. Giving to m the value 0·5, the actual result may be thus analysed :—

Virtual primary extraction $= e_p = (m - f)/m(1 - f) =$
$(5 - 0·15)/0·5\ (1 - 0·15) = 0·8235$.

Virtual secondary extraction $= e_a - e_p = 0·92 - 0·8235 = 0·0965$.

Virtual loss in primary bagasse $= 1 - e_p = 1 - 0·8235 = 0·1765$.

Virtual value of $R = R_v = (e_a - e_p)/(1 - e_p) = 0·0965/0·1765 = 0·5467$.

If f changes to 0·125

$e_p = (m - f)/m\ (1 - f) = = 0·8571$

$1 - e_p = 1 - 0·8571 = 0·1429$

$(1 - e_p)R_v = 0·1429 \times 0·5467 = 0·0781$

$e = 0·8571 + 0·0781 = 0·9352$.

This is the extraction, following on the arguments developed above, of the milling plant under analysis, with fibre reduced to 12·5 per cent. and it may be expressed by the cypher $e(0·125, 2, 1·67) = 0·9352$.

It should be observed that when f changes to 0·125, $w/f = k$ remains constant at 1·67 but w changes from 0·25 to 0·208.

(2) It is required to reduce the milling results in (1) above to a basis (*a*) of $n = 3$, f and k remaining unchanged and (*b*) to a basis of $f = 0{\cdot}125$, $n = 3$, k remaining unchanged.

R_v for $n = 2$ has already been found to be 0·5467. Referring to Table I, the corresponding value of r is 0·4141 and the value of R_3 is 0·608.

Hence the value of e for $n = 3$ and $f = 0{\cdot}150$, $k = 1{\cdot}67$ is $0{\cdot}8235 + 0{\cdot}608 \times 0{\cdot}1765 = 0{\cdot}9308$.

If f change to 0·125 and n change to 3, k remaining at 1·67, the value of e is :—

$$0{\cdot}8571 + 0{\cdot}608 \times 0{\cdot}1429 = 0{\cdot}9439.$$

This last result may be expressed as $e\ (0{\cdot}125,\ 3,\ 1{\cdot}67) = 0{\cdot}9439$.

TABLE I.

Values of $R = (s + s^2 + \ldots + s^n)/(1 + s + s^2 + \ldots + s^n)$ for values of $s = 0{\cdot}20 — 3{\cdot}0$ and for n 1 — 5. When $n = 1$, R is $= r$ and s is always $= r/(1 — r)$.

$s = r/(1 — r)$ and $= k$ for $m = {\cdot}5$	$R_1 = r$	R_2	R_3	R_4	R_5
0·20	0·1667	0·1935	0·1987	0·1998	0·1999
0·25	0·2000	0·2381	0·2471	0·2493	0·2498
0·30	0·2307	0·2806	0·2943	0·2995	0·2998
0·35	0·2593	0·3208	0·3401	0·3466	0·3488
0·40	0·2857	0·3589	0·3842	0·3975	0·3989
0·45	0·3134	0·3948	0·4265	0·4396	0·4454
0·50	0·3333	0·4286	0·4667	0·4839	0·4921
0·55	0·3548	0·4602	0·5047	0·5262	0·5371
0·60	0·3750	0·4898	0·5404	0·5667	0·5805
0·65	0·3939	0·5175	0·5739	0·6041	0·6214
0·70	0·4118	0·5434	0·6052	0·6394	0·6600
0·75	0·4286	0·5676	0·6343	0·6722	0·6959
0·80	0·4444	0·5902	0·6612	0·7025	0·7292
0·85	0·4595	0·6113	0·6862	0·7304	0·7592
0·90	0·4737	0·6310	0·7092	0·7558	0·7866
0·95	0·4872	0·6494	0·7304	0·7789	0·8118
1·00	0·5000	0·6667	0·7500	0·8000	0·8333
1·05	0·5122	0·6833	0·7680	0·8191	0·8530
1·10	0·5238	0·6979	0·7845	0·8362	0·8704
1·15	0·5349	0·7119	0·7998	0·8516	0·8857
1·20	0·5454	0·7253	0·8137	0·8656	0·8993
1·25	0·5555	0·7374	0·8265	0·8769	0·9112
1·30	0·5652	0·7493	0·8384	0·8894	0·9216
1·35	0·5745	0·7603	0·8492	0·8995	0·9307
1·40	0·5833	0·7706	0·8592	0·9087	0·9387
1·45	0·5918	0·7803	0·8684	0·9168	0·9457
1·50	0·6000	0·7895	0·8769	0·9242	0·9519
1·55	0·6078	0·7981	0·8850	0·9308	0·9572
1·60	0·6154	0·8062	0·8920	0·9367	0·9620
1·65	0·6226	0·8139	0·8980	0·9421	0·9661
1·70	0·6296	0·8211	0·9048	0·9470	0·9700
1·75	0·6364	0·8271	0·9105	0·9513	0·9729
1·80	0·6429	0·8344	0·9159	0·9557	0·9758
1·85	0·6491	0·8406	0·9207	0·9589	0·9783
1·90	0·6552	0·8464	0·9253	0·9621	0·9805
1·95	0·6610	0·8519	0·9294	0·9651	0·9824
2·00	0·6667	0·8571	0·9333	0·9677	0·9841
2·05	0·6721	0·8621	0·9369	0·9702	0·9857
2·10	0·6774	0·8668	0·9404	0·9726	0·9869
2·15	0·6825	0·8714	0·9441	0·9744	0·9882
2·20	0·6875	0·8756	0·9465	0·9763	0·9893
2·25	0·6923	0·8797	0·9492	0·9779	0·9902
2·30	0·6970	0·8836	0·9518	0·9795	0·9912
2·35	0·7015	0·8873	0·9542	0·9809	0·9919
2·40	0·7059	0·8908	0·9565	0·9822	0·9926
2·45	0·7102	0·8942	0·9586	0·9834	0·9932
2·50	0·7143	0·8974	0·9606	0·9843	0·9938
2·55	0·7183	0·9005	0·9625	0·9855	0·9943
2·60	0·7222	0·9035	0·9642	0·9864	0·9948
2·65	0·7260	0·9063	0·9658	0·9873	0·9952
2·70	0·7297	0·9090	0·9674	0·9881	0·9956
2·75	0·7333	0·9124	0·9697	0·9889	0·9960
2·80	0·7368	0·9141	0·9702	0·9895	0·9963
2·85	0·7403	0·9163	0·9715	0·9901	0·9965
2·90	0·7436	0·9188	0·9727	0·9907	0·9968
2·95	0·7468	0·9210	0·9739	0·9912	0·9970
3·00	0·7500	0·9231	0·9750	0·9917	0·9973

(3) It is required to reduce the milling result in 1 above to a basis of $f = 0{\cdot}125$, $n = 3$, $k = 2{\cdot}5$.

The value of r has already been determined as 0·4141.

The idea value of r for $k = 1{\cdot}67$ is from Table I, 0·6249.

The ratio of these values is $0{\cdot}4141/0{\cdot}6249 = 0{\cdot}6627$.

The value of r for $k = 2{\cdot}5$ is 0·7143 and $0{\cdot}7143 \times 0{\cdot}6627 = 0{\cdot}4734$.

The value of R_3 for $r = 0{\cdot}4734$ is 0·708, whence the value of $e\ (0{\cdot}125,\ 3,\ 2{\cdot}5)$ is $0{\cdot}8571 + 0{\cdot}708 \times 0{\cdot}1429 = 0{\cdot}9583$.

It will be observed in this last example that when once the value of a or the ratio of the actually observed to the ideal value of r is fixed, the value of $e(0\cdot125, 3, 2\cdot5)$ is also determined. For the convenience of those who care to use this method of comparison, I have given in Table III, the extraction of $f = 0\cdot125$, $n = 3$, $k = 2\cdot5$ corresponding to the value of a and for this value I propose the term " Reduced Extraction " or briefly e_r, which it is pretended will afford a measure of the efficiency of operation of a milling plant with the effect of fibre, quantity of added water and number of units in the imbibition train eliminated.

The method of comparison of results used in Java is the quantity "Undiluted juice in last bagasse per unit of fibre in cane;" and in the notation which I use this is equivalent to the value of the expression $(1 - e)(1 - f)/f$. This method of comparison corrects for the influence of fibre only and is then identical in application but not in form with the example (I) above. Referring to this example :—

$$(1 - e)(1 - f)/f = (1 - 0\cdot92)(1 - 0\cdot15)/0\cdot15 = 0\cdot4533$$

which is the undiluted juice lost in last bagasse.

TABLE II.

Value of $(m - f)/m(1 - f)$ for values of f 0·1 to 0·18 and for a constant value of $m = 0\cdot5$.

f	$(m-f)/m(1-f)$	f	$(m-f)/m(1-f)$	f	$(m-f)/m(1-f)$	f	$(m-f)/m(1-f)$
0·100	0·8889	0·120	0·8636	0·140	0·8372	0·160	0·8095
0·101	0·8877	0·121	0·8623	0·141	0·8359	0·161	0·8081
0·102	0·8864	0·122	0·8610	0·142	0·8345	0·162	0·8067
0·103	0·8852	0·123	0·8597	0·143	0·8331	0·163	0·8052
0·104	0·8839	0·124	0·8584	0·144	0·8318	0·164	0·8038
0·105	0·8827	0·125	0·8571	0·145	0·8304	0·165	0·8024
0·106	0·8814	0·126	0·8558	0·146	0·8290	0·166	0·8009
0·107	0·8802	0·127	0·8545	0·147	0·8277	0·167	0·7995
0·108	0·8789	0·128	0·8532	0·148	0·8263	0·168	0·7980
0·109	0·8776	0·129	0·8519	0·149	0·8249	0·169	0·7966
0·110	0·8764	0·130	0·8506	0·150	0·8235	0·170	0·7952
0·111	0·8751	0·131	0·8492	0·151	0·8221	0·171	0·7937
0·112	0·8738	0·132	0·8479	0·152	0·8208	0·172	0·7923
0·113	0·8726	0·133	0·8466	0·153	0·8194	0·173	0·7908
0·114	0·8713	0·134	0·8452	0·154	0·8180	0·174	0·7893
0·115	0·8701	0·135	0·8439	0·155	0·8166	0·175	0·7879
0·116	0·8688	0·136	0·8426	0·156	0·8152	0·176	0·7864
0·117	0·8675	0·137	0·8412	0·157	0·8138	0·177	0·7849
0·118	0·8662	0·138	0·8399	0·158	0·8123	0·178	0·7834
0·119	0·8649	0·139	0·8386	0·159	0·8109	0·179	0·7820

Giving to f the value 0·125 and solving for e in the equation :—

$$(1 - e)(1 - 0\cdot125)/0\cdot125 = 0\cdot4533$$

$$e = 0\cdot9352, \quad \text{as found before.}$$

It appears then that the method of comparison based on "Undiluted juice lost in bagasse per unit of fibre" is a special case of the general solution which I here propose and that for every value of "verloren sap" (the term used in Java) there is a corresponding value of the extraction reduced to a fibre basis of 12·5 per cent. or shortly to $e(0{\cdot}125)$. If v be written for "verloren sap," these values are connected by the equation :—

$$(1 - e)(1 - f)/f = v$$

and if to f the value 0·125 be given

$$e = (7 - v)/7 \text{ and } v = 7(1 - e).$$

In the three examples which I have selected for solution the values of e were found to be 0·9352, 0·9439 and 0·9583 respectively. The corresponding values of v are 0·4533, 0·3920 and 0·2926.

In the opinion of the writer, expression by reference to extraction is more appealing and definite, but this is of course a matter for the personal equation. A tabulation of equivalences of $e(125)$ and of v has been worked out and is given in Table IV.

It should be mentioned that "verloren sap" in Java is worked out on Brix and not on sugar. I agree with SYLMANS[1] that Brix is the more rational basis mainly because the variation in Brix is much less than the variation in sugar and that the use of Brix will give more definite figures regarding the mechanical operation of the plant. On the other hand, the executive is concerned more with the extraction of sugar than with the extraction of solids.

As criticisms of the proposed scheme I may point out :—

(1) It has been observed by SYLMANS[1] that there is a tendency for the primary extraction to vary with the fibre in cane and hence he has rejected as invalid the use of the primary extraction as a measure of milling efficiency. I have already pointed out that this criticism applies equally to the validity of the use of "verloren sap" and in this present article have shown that the present scheme of reduction to a uniform fibre basis with n and k unchanged gives a result identical in significance but different in form to the use of "verloren sap."

(2) Where criticism may be directed is against the attempt to correct for variation in the value of $w/f = k$. It is known that as the quantity of added water increases its coefficient of admixture decreases. The method will therefore tend to give a fictitiously high value to the values of the reduced extraction for those cases where less quantities of added water are employed.

(3) While the development of the basic equation and the calculation of the necessary tables have required a certain amount of labour, I am not prepared to admit that the method is complicated or laborious in application. The reduction of any result to the proposed standard can be done with the aid of the tables here submitted in less than two minutes.

(4) An arbitrary or artificial element still remains in the scheme by virtue of the selection of the value 0·5 for m. Different values of $e(0{\cdot}125, 3, 2{\cdot}5)$ will follow for every value given to m.

1 Bull. 37, Third Cong., Int. Soc. Cane Sug. Tech.

Table III.

Table giving "Reduced Extraction," referred to a train of one primary and three secondary units for a constant value of $m = 0{\cdot}5$, $f = 0{\cdot}125$ and $w/f = k = 2{\cdot}5$. The captions refer to the ratio, a, of the actual factor of extraction, r_a, to the ideal factor of extraction, r_i.

	0·3	0·4	0·5	0·6	0·7	0·8	0·9
00	0·8955	0·9120	0·9298	0·9477	0·9643	0·9780	0·9879
05	0·8963	0·9129	0·9307	0·9486	0·9650	0·9786	0·9883
10	0·8971	0·9137	0·9316	0·9495	0·9658	0·9792	0·9887
15	0·8979	0·9146	0·9325	0·9504	0·9665	0·9797	0·9891
20	0·8987	0·9155	0·9334	0·9512	0·9672	0·9802	0·9895
25	0·8995	0·9164	0·9343	0·9521	0·9679	0·9808	0·9899
30	0·9003	0·9172	0·9352	0·9529	0·9687	0·9813	0·9902
35	0·9011	0·9181	0·9361	0·9538	0·9694	0·9819	0·9906
40	0·9019	0·9190	0·9370	0·9546	0·9701	0·9824	0·9909
45	0·9027	0·9199	0·9379	0·9555	0·9708	0·9830	0·9913
50	0·9036	0·9208	0·9388	0·9563	0·9715	0·9834	0·9916
55	0·9044	0·9217	0·9397	0·9571	0·9722	0·9839	0·9919
60	0·9052	0·9226	0·9406	0·9579	0·9729	0·9844	0·9922
65	0·9080	0·9235	0·9415	0·9587	0·9736	0·9849	0·9925
70	0·9069	0·9244	0.9424	0·9595	0·9743	0·9853	0·9928
75	0·9077	0·9253	0·9433	0·9603	0·9749	0·9858	0·9931
80	0·9086	0·9262	0·9442	0·9611	0·9756	0·9863	0·9933
85	0·9094	0·9271	0·9451	0·9619	0·9762	0·9867	0·9936
90	0·9103	0·9280	0·9460	0·9627	0·9768	0·9871	0·9939
95	0·9111	0·9289	0·9469	0·9635	0·9774	0·9875	0·9941

Table IV.

Correspondence between values of "verloren sap," v, and extraction, e, reduced to a basis of 12·5 per cent. fibre, e (0·125).

v	e (0 125)	v	e (0·125)	v	e (0·125)	v	e (0·125)
0·00	1·0000	0·20	0·9714	0·40	0·9429	0·60	0·9143
0·01	0·9986	0·21	0·9700	0·41	0·9414	0·61	0·9129
0·02	0·9971	0·22	0·9686	0·42	0·9400	0·62	0·9114
0·03	0·9957	0·23	0·9671	0·43	0·9386	0·63	0·9100
0·04	0·9943	0·24	0·9657	0·44	0·9371	0.64	0·9086
0·05	0·9929	0·25	0·9643	0·45	0·9357	0·65	0·9071
0·06	0·9914	0·26	0·9629	0·46	0·9343	0·66	0·9057
0·07	0·9900	0·27	0·9614	0·47	0·9329	0·67	0·9043
0·08	0·9886	0·28	0·9600	0·48	0·9314	0·68	0·9029
0·09	0·9871	0·29	0·9586	0·49	0·9300	0·69	0·9014
0·10	0·9857	0·30	0·9571	0·50	0·9286	0·70	0·9000
0·11	0·9843	0·31	0·9557	0·51	0·9271	0·71	0·8986
0·12	0·9829	0·32	0·9543	0·52	0·9257	0·72	0·8971
0·13	0·9814	0·33	0·9529	0·53	0·9243	0·73	0·8957
0·14	0·9800	0·34	0·9524	0·54	0·9229	0·74	0·8943
0·15	0·9786	0·35	0·9500	0·55	0·9214	0·75	0·8929
0·16	0·9771	0·36	0·9486	0·56	0·9200	0·76	0·8914
0·17	0·9757	0·37	0·9471	0·57	0·9186	0·77	0·8900
0·18	0·9743	0·38	0·9457	0·58	0·9171	0·78	0·8888
0·19	0·9729	0·39	0·9443	0·59	0·9157	0·79	0·8871

The European Beet Sugar Crop of 1930-31.

By H. C. PRINSEN GEERLIGS, Ph.D.

The figures for the 1930-31 European beet sowings, expressed in hectares, and those of the sugar production in metric tons, raw value, are given here, together with those for 1929-30 as a comparison :—

	1929-30.		1930-31.	
	Hectares.	Tons sugar.	Hectares.	Tons sugar.
Germany	433,015	1,984,748	468,293	2,528,591
Czechoslovakia	227,258	1,037,877	237,038	1,125,690
Austria	29,687	120,370	35,610	150,212
Hungary	72.975	246,513	65,653	233,793
Poland	242,014	918,689	179,912	791,980
France	243,100	898,738	259,210	1,195,894
Belgium	53,500	252,048	51,839	283,234
Netherlands	55,002	264,871	57.462	295,822
Denmark	29,990	127,800	31,900	167,800
Sweden	27,467	121,404	35,624	186,535
Italy	116,111	440,822	113,700	410,656
Spain	80,000	245,000	91,000	310,000
Danzig	7,561	30,000	11,000	45,000
Yugo-Slavia	61,228	122,000	51,356	102,693
Bulgaria	20,000	40,000	21,500	57,650
Rumania	36,000	82,000,	44,000	140,000
Switzerland	1,160	6,000	1,500	7,000
United Kingdom	92,800	325,000	138,903	473,000
Ireland	4,800	20,000	5,360	25,784
Finland	1,476	3,000	1,175	4,290
Latvia	2,000	4,000	2,500	4,500
Lithuania	—	—	700	1,000
Turkey	3,000	6,000	4,500	10,000
Russia	784,000	910,000	1,044,000	1,985,000
Total	2,624,194	8,214,080	2,953,735	10,536,124

In Europe, except Russia, the sowings have been slightly extended from 1,840,000 hectares to 1,909,000 or by 3·7 per cent. As, however, Russia undertook a great expansion of output from 784,000 hectares to 1,044,000 (or by no less than 33 per cent.), the total increase in European sowings amounted to over 300,000 hectares, or 18·1 per cent.

On the whole, the sugar production to the hectare proved very good, in some countries even exceptionally so, as will be shown further on, and this accounts for the fact that the increase in sugar production has exceeded the increase in sowings considerably.

Apart from Russia, the European crop increased from 7,294,000 tons to 8,619,000 or 18·1 per cent., and as Russian production increased by 1,790,000 tons or 130 per cent the total European sugar production of 1930-31 exceeded its predecessor by 2,312,000 tons or 28·5 per cent.

Consumption is calculated at 10,800,000 tons raw value or something more than during 1929-30, when it was 10,357,000 tons, but the unfavourable economic situation prevailing in Europe and the still existing rationing of sugar consumption in Russsia are an impediment to any return to that wider use of sugar, to which the European nations had become accustomed after the war.

The heavy crop and the relatively moderate consumption, combined with little or no desire on the part of the trade to lay in stocks, have caused the final stocks to accumulate to an unpleasant degree and the fact of such an occur-

rence has had much to do with the eagerness displayed by the great European exporting countries to participate in the Brussels Convention of 1931.

Germany.—Although the price of sugar and that of beets was not promising, the German beet growers extended their sowings by 35,000 hectares or 8 per cent.; and this for the reason that the price of other crops was not any more favourable, and beetroots, at any rate, are sure to bring in ready money at harvest time, while other crops have to be stored in these years. The weather proved very profitable for the crop, especially in October when a good dry spell and high temperatures sent up the sucrose content of the roots. The sugar production went up by 554,000 tons or 28 per cent., and the yield per hectare from 4530 kg. to 5378 or by 19 per cent. In all, 233 factories were active, against 238 in 1929-30, showing that the process of consolidation, which has reduced the number of 402 sugar-houses existing in 1899-1900 to its present low figure, still goes on.

The German sugar exportation has not come up to expectations, since its net amount is only 414,000 tons, a figure which during the negotiations last winter in Brussels, Berlin and Paris was considered as far too low; indeed, one of 500,000 was the last concession to which the German sugar manufacturers would agree. According to the stipulations of the Convention, the deficit of 86,000 tons may be divided up between the other parties, excluding Java.

In *Czechoslovakia* conditions were very similar to those prevailing in Germany. Owing to the low price of other crops, the beet sowings were extended in this case by 10,000 hectares or 4 per cent., and the sugar crop rose by 100,000 tons or about 10 per cent. The output of sugar to the hectare increased from 4,480 kilos to 4,723 or by 5·4 per cent. A total of 140 factories have worked against 141 in 1929-30. Czechoslovakia continued to export a great percentage of its sugar output, and to the usual destinations. Calculated on the raw sugar basis, exports amounted to 530,540 tons, against 603,201 in 1929-30. The exports, therefore, were almost equal to the amount anticipated during the discussions preceding the Sugar Convention, since a figure of 570,817 tons was kept in view. The insignificant deficit may not be carried over to another year or to another party, and is therefore ruled out of calculation.

In *Austria* the Government is ever busy in stimulating sugar production by the granting of facilities to producers. As a consequence of these endeavours, the sowings were extended by 6000 hectares or 20 per cent., and the crop by 30,000 tons or 25 per cent. The sugar production went up from 4040 kg. per hectare to 4213, or by 4 per cent. Notwithstanding the increase mentioned above, production is still below the country's requirements, so that 67,668 tons had to be imported from Czechoslovakia and from Hungary. The number of factories remained the same, viz. 7.

Hungary heads the list of countries where beet sowings have undergone a reduction, viz. by 7300 hectares or 10 per cent. The sugar production declined by 13,000 tons or by 5 per cent. The production of sugar to the hectare went up from 3370 kg. to 3570, or by 6 per cent. The number of factories working up the crop did not undergo any variation, remaining at 17. As Hungary consumed about 115,000 tons and did not import any sugar, it had a good supply to export, of which it availed itself freely; 83,000 tons crossed the frontier, especially to Austria, Balkan States, Asia Minor, Egypt and even India. The figure of exportation (foreseen oy the Brussels Convention to the amount of 84,100 tons) was 83,313.

The *Polish* Government was impressed by the heavy surplusses left by the 1929-30 crop, and consequently took steps to diminish sowings for 1930-31. Accordingly these decreased by 62,000 hectares or by 25·6 per cent. and the sugar crop by 136,000 tons or by 15 per cent. In Poland sugar production to the hectare increased from 3940 kg. to 4400 or 12 per cent. Consumption did not attain the scope of that of late years, being 362,371 tons against 394,947 tons in 1929. The country could export its full quotum allotted by the Brussels Convention, being 308,812 tons, whereas exportation amounted to 306,000 tons with destination to the Russian border states, Netherlands, Great Britain, etc. The stocks increased from 153,400 tons to 252,200 thus giving no relief to the holders of the article, which in August, 1930, had already far too great a stock left on their hands. Sixty-nine factories worked, against 70 in the year before.

In *Belgium* sowings slightly decreased, viz. by 1700 hectares or 3·5 per cent. Production went up by 31,000 tons or about 6 per cent. but since Belgium imports beetroots from the Netherlands and exports them also to that country and to France, there is no direct proportion between acreage and sugar production. Belgium consumed 235,000 tons of sugar, imported 63,100 tons of raws and exported 94,100 tons of refined, thus showing a net exportation of 29,600 tons at each sugar base or about on the scale of the Brussels Convention allowance, which permits a quotum of 30,275 tons. Forty-three factories have been active, against 46 in 1929-30.

In the *Netherlands* the beet area was increased by 2460 hectares or 4 per cent., and the sugar production went up by 35,000 tons or by 13 per cent. In that country too the proportion between hectares under beets and sugar produced is not apparent from the totals, as many roots are exported either to Belgium or to France. The quantity of beet worked up was 1,914,403 tons, or 212,234 more than in 1929-30. The amount of sugar turned out in 100 parts of beet was 15·45 and 15·58 respectively in 1930-31 and 1929-30. The importation of raws from abroad with the aim of being re-exported as refined is dwindling rapidly since Great Britain's disappearance as a customer for foreign refined. The Netherlands consumed 241,351 tons of sugar and exported 60,000 tons in the shape of sugared articles, such as condensed milk, liqueurs, cakes, biscuits, jams, etc., and 48,000 tons as such.

France is no longer the happy country sheltered against low sugar prices by a high tariff wall and a sugar production which can find its entire market within that wall. Sowings were extended by 16,000 hectares or by 7 per cent., sugar production went up by 297,000 tons or by 12·2 per cent., and as consumption has not gone beyond 979,892 tons of refined sugar, equivalent to 1,088,780 tons of raws, the home production has exceeded the home consumption by 107,114 tons. Further, France imported sugar from her colonies to the extent of 90,000 tons, but was able to dispose of 260,000 tons to her privileged markets in Algeria, Tunis and Morocco. Nevertheless the country finds itself overstocked on the 31st August, 1931, and since it is no party to the Brussels Convention, it has resorted to a kind of private agreement. The holders have segregated 180,000 tons of domestic and 10,000 tons of colonial sugar from the old crop and have managed thereby to offer no more to the trade than just sufficient to cover the demand, thus keeping the price at a fair level.

In *Denmark* the disagreements between growers and manufacturers which, last year, were responsible for a notable shrinkage in sowings have been smoothed out, resulting in a return to the former level. The 1930-31

sowings amounted to 31,900 hectares with 143,300 tons of sugar, against 29,990 and 127,800 respectively in 1930, but against 41,200 and 170,000 in 1928-29. The country consumed 210,000 tons and consequently had to import for its own wants and those of the Faroes, Iceland, and Greenland.

In *Sweden* conditions were pretty much like those in Denmark. Acreage sown rose from 25,037 to 35,624 hectares and production from 121,400 tons to 186,533, against 42,621 hectares and 160,860 tons respectively in 1929. Consumption was 250,000 tons, necessitating importation from Germany, Poland, Czechoslovakia and the Netherlands.

Italy has not only found a way to cover its own demands, but made a considerable surplus, which could not be exported as a consequence of the high cost of production. The area sown was slightly less than in 1929-30, but sugar production increased by 17,000 tons or by 15 per cent., causing the initial stock of 100,000 tons to exceed its already embarrassing quantity by another 2,000 tons.

Spain is steadily increasing both sowings and production, and since home consumption can, up to now, absorb everything produced, there is no accumulation of stocks, no importation and no exports.

In *Great Britain* the sowings were again extended, viz. from 92,800 to 138,903 hectares. Since the official figures can be found on page 282 (June), there is no need to repeat them here.

The *Balkan States* (Rumania, Bulgaria and Yugo-Slavia) kept their positions, as is shown here :—

	Area.	Production.	Consumption.
1929-30	117,228	254,000	290,000
1930-31	116,856	298,000	280,000

The surplus is locked up in Rumania and will be distributed next year.

The *Other Countries* are Danzig, Switzerland, Finland, Latvia, Lithuania and Turkey, which between them planted 26,735 hectares and produced 96,000 tons, against 20,000 hectares and 69,000 tons in 1929-30. Danzig especially extended her production, the others remaining more or less stationary. The only country offering a great contrast to the year before is *Russia*, where according to the Patjiletka or Five Years' Plan sowings were vastly increased from 784,000 to 1,044,000 hectares. Moreover, the production of sugar to the hectare has been better than in the unfavourable year of 1929-30, but is still not so good as it was in 1927-28.

The Russian figures for the last five years are as follows :—

	Hectares sown.	Sugar produced Total tons.	to the hectare. Kg.
1926-27	531,600	873,420	1,643
1927-28	640,000	1,501,986	2,347
1928-29	769,000	1,396,000	1,813
1929-30	784,000	910,000	1,161
1930-31	1,044,000	1,985,000	1,916

The first estimates for 1930-31 ran up to 2 million tons of white sugar, but gradually it appeared that the capacity of the transport and the factories was inadequate to cope with the enormous amount of beet-roots. The figures dropped lower and lower, and in the end reached the final value of 1,786,800 tons of white, equivalent to 1,985,000 tons of raw sugar.

The invasion of Europe, Asia, Africa, etc., by cheap Russian sugar, which served as a scarecrow during 1930, has confined itself to 140,000 tons of not too good sugar to British India, some 25,000 tons to Western destinations

and the usual 200,000 tons overland to Persia, Afghanistan, Asia Minor, Mongolia, Manchuria, etc.

Europe produced 10,556,000 tons and consumed 10,800,000 tons ; moreover, it needed about 700,000 tons for the customary exportation to privileged markets in Northern Africa, Asia Minor and Central Asia. Furthermore, sugar was exported to British India, but since much sugar to which privileges were granted came in from British, French and Portuguese territories and also some from South America and Cuba, the stocks in Europe accumulated greatly as is shown in the table underneath.

	1st September, 1930.	31st August, 1931.
Germany	283,517	735,442
Czechoslovakia	114,745	313,236
Austria	12,548	36,118
Hungary	14,492	47,280
Poland	155,312	252,200
France	212,675	304,450
Netherlands	77,062	154,373
Belgium	61,283	65,811
United Kingdom	181,172	223,351
Total	1,112,806	2,132,261

The measures taken in almost every European country, except Russia, to restrict sowings for the 1931-32 crop will undoubtedly lead to a decrease of these surplus stocks, all the more, as it is not to be expected that the agricultural results in 1931 will be as bountiful as they were in the preceding year.

Fertilization for Soil Amendment and Maintenance.[1]

By H. P. AGEE.

Some years ago a writer on soil fertility and crop production—I think he hailed from West Virginia—said, " The best way to maintain the fertility of a soil is to make it produce big crops."

This interesting statement gives pause for thought for there seems to be, in the minds of some, an incompatibility between continuous heavy cropping and *permanent agriculture.*

Many of the prophets on soil tillage connect permanent agriculture inseparably with fallowing, rotation of crops, green manuring, the ploughing under of crop residues. They lay great stress upon "incorporating organic matter with the soil."

Save for a few exceptions, we do none of these things in Hawaii, yet we have an agriculture that we like to think of as having a permanent character.

In our sugar agriculture we seem to be committed to a manuring policy of chemical fertilizers, supplemented by filter-press mud, and perhaps by molasses when that product suffers lack of a good market price. One or two plantations plough under cane trash, but in general we find it more profitable to burn this crop residue. The manure from our stables is used on the fields, but this commodity becomes scarcer as the tractor gains in popularity. We have not as yet seen fit to make compost piles of our cane trash as is done in some of the British colonies and in Formosa.

What, under these circumstances, can we say of the amendment and maintenance of soil fertility ?

1 A paper read at the Fiftieth Annual Meeting of the Hawaiian Planters' Association.

Fertilization for Soil Amendment and Maintenance.

Can we maintain soil fertility by producing big crops? Or do these big crops strain our soil, rob it of some essential, for the lack of which future crops will suffer?

Must we—can we, in fact—determine what is the best and most economical fertilizer for current crops, say those of 1931 and 1932, and then determine something else, do something else, for the sake of the crops of 1941 and 1942, or for those of '51 and '52?

These, I take it, are questions to be dealt with under the subject that has been assigned me. It is to be regretted that there is so little of a precise nature that can be said in answer to them.

Yet, questions they are, and they deserve to be asked, and asked again, pondered over, made a part of our research activities. Failing to answer them precisely, we should discuss ways and means of developing the information for which they call.

This is naturally enough not the first time that we, at the Experiment Station, have concerned ourselves over these issues. Some years ago we had desire to know what the oldest of experiment stations, Rothamsted, would say on our fertilization policies. Mr. FREDERICK MUIR, on a trip to England, kindly explained our agriculture and use of fertilizers and presented our problem substantially as follows:—[1]

"Can we continue to raise big crops for years and years on chemical fertilizers? Are we depleting the organic matter of the soil and altering its water holding capacity, or are we actually maintaining this or perhaps increasing it by producing huge root systems year after year with chemical nitrogen, these, on decaying, adding to the organic matter of the soil itself?

"Rothamsted experiments tell of maintaining yield by chemical nitrogen to an extent that is equal to, if not greater than, what is done by continuous applications of barnyard manure.

"With wheat and other grain crops we are told that the cost of the chemical nitrogen necessary to do this is prohibitive from a commercial standpoint. With sugar this is not so. 300 lbs. of nitrogen at 20 cents a lb. costs $60.00, which amounts to $5.00 per ton on a 12-month crop.

"Under these circumstances, is not our agriculture sound and 'permanent' from the standpoint of the Rothamsted work dealing with the maintenance of yields through chemicals only?"

In December, 1922, Mr. MUIR wrote us of the opinion expressed on our intensive sugar agriculture, considered in the light of nearly eighty years of investigations dealing with chemical fertilizers in their effect upon the soils and crops of England, those investigations including comparisons between chemical and organic manures.

Mr. MUIR said: "I paid a visit to Rothamsted . . . had a long talk with Dr. RUSSELL.[2] He was surprised to hear that you were using nitrate of soda without it showing ill effect, he expected you were using nitrate of ammonia. He was also surprised that so little of the green crop had been returned to the soil on many of the plantations. But he said, after considering these points, that there was no evidence to be drawn from any of their work at Harpenden that indicated that our methods were not along the lines of permanent agriculture."

Eight years have passed. In 1922, the sugar plantations of these islands produced 4·79 tons of sugar per acre; in 1929 those plantations produced 6·88 tons of sugar per acre. In 1922, the Ewa Plantation Company produced

[1] From *Hawaiian Planters' Record*, Vol. XXVII, p. 1.
[2] Now Sir John Russell.

9·23 tons per acre; in 1930 that plantation has announced a crop averaging 12·07 tons of sugar per acre.

In so far as may be judged by results to date, Hawaiian policies of fertilization, and Sir JOHN RUSSELL's endorsement of them, appear to have been well founded. During the years intervening between 1922 and to-day, it must be pointed out that changes in the reserve of phosphoric acid and potash have been noted on a number of plantations. There has been a definite increase in the use of potash and phosphate salts as fertilizers.

Ten or fifteen years ago 50 or 60 lbs. each of P_2O_5 and K_2O were the common applications; to-day we find applications of 150 and 200 lbs. to be rather common (sometimes 300 lbs.). On many plantations this is in response to clearly defined demands based on yield tests, on others, where the requirement is less evident, the larger application takes the form of a precautionary measure. Phosphate and potash are so much cheaper than nitrogen that the efficiency of the dearer element is not to be risked for lack of the supporting "balance" of the less expensive ingredients. Furthermore, there is the permanency of our agriculture to be thought of, the problem of maintaining or building up adequate reserves to enlist our attention.

This question of the reserves is disconcerting when we look at our potash bank book.

Additional figures have recently been published by our chemists and agriculturists showing plant food ingredients removed from the soil. ARTHUR AYRES has shown that sugar cane at Waipio can consume 400, or 500, or 600 lbs. of potash per acre in crops running 18 to 24 months; the cane of one area, allowed to grow 30 months, consumed at the rate of 800 lbs. per acre.

It is true that a portion of this goes back to the soil from the ash of burned leaves, or dry trash, nevertheless the draft on the potash of the soil is extremely high and cannot be maintained by applications of 200 lbs. per acre. To supply, in the form of potash salts, the actual amount of potash that is being removed, we incur the danger of thereby depressing the yields of cane. This is one of the problems of fertility maintenance, one that needs further investigation.

What of returning this potash by adding molasses?

A. F. HECK is studying what happens when molasses is added to soil, including an investigation of the ultimate form taken by the potash of the molasses. It remains to be seen whether we can build up potash reserves in this way; whether the molasses will render more soluble such potash reserve as the soil has, and thereby hasten its depletion; or whether a large part of the potash of the molasses will be fixed and held by the soil unavailable to the plant.

We are accustomed in our soil analyses to deal with three forms of potash. There is the total amount held by the soil including that part which can be brought into solution only after a process of fusion that breaks down the otherwise insoluble state in which it is held; secondly, the fraction that is soluble in a hydrochloric acid of standard strength, representing roughly, it is estimated, that part which may be expected to become available as time proceeds; and thirdly, the fraction soluble in 1 per cent. citric acid, that is, the more readily available portion. Remembering that these dividing lines of solubility are not absolute and that the different fractions we speak of may in part change in form (and solubility), and that we are dealing at best with a crude attempt to use the laboratory to fathom the vital natural processes of the field, we can nevertheless find interest in aligning these fractions of potash of the soil with the amount of potash we find within the plant at harvest.

Take, for example, a Waipio soil, apply the percentages to 5,000,000 lbs. of soil presumably within reach of cane roots and we find :—

Total potash, 0·50 per cent. or 25,000 lbs.

Potash soluble in hydrochloric acid 0·15 per cent. or 7500 lbs.

Potash soluble in citric acid (1 per cent.) 0·055 per cent. or 2750 lbs.

Potash consumed by one crop of cane—500 lbs.

This does not mean, necessarily, that so large a consumption of potash is essential to cane growth, for we have records of apparent successful growth with a much lower amount. Nor can we conclude that by adding the potash that the crop is removing, we thereby maintain an even supply. It is just as probable that such a procedure would cause the plant to consume still larger amounts.

Our soils contain far less phosphoric acid than potash, and the use of phosphates by sugar cane is correspondingly lighter. AYRES shows from his work at Waipio, 100 to 150 lbs. of P_2O_5 removed per acre by sugar cane growth. There is a wide variation in the phosphate content of our soils. In some there is such a supply that there is uncertainty of gain from phosphate applications. In others the gains from the phosphates have been so high as to render phosphate applications a major consideration in successful cropping. Several plantations have undertaken to build up these weak phosphate reserves, and with fair success. Both acid phosphate and raw phosphate rock have been used. There was at one time a feeling that raw phosphate rock could be applied at will for this purpose but more recently there appear instances of crop depression from its use in large amounts.

On the whole, however, we can undertake to strengthen weak phosphate reserves with greater certainty than weak potash reserves.

Fertilization with nitrogen is a more direct undertaking. We seldom determine the nitrogen content of a soil. It is clearly known that if we add too little we sacrifice our yield of sugar, that if we add too much we get rank cane growth, and lower yields of sugar through poor juices. We attempt to feed the nitrogen to the cane, crop by crop, and do not concern ourselves about building nitrogen reserves by means of nitrogen salts.

What about the organic matter of the soil ? The use of stable manure, filter-press mud, and the limited use of crop residues is known to all. Independently of these, we tend to maintain a fair reserve of organic matter as we produce, crop after crop, a heavy mass of sugar cane roots. We know that the roots of each crop decay in the soil, and that each crop of ratoons produces its own system of roots, making no use of the roots of the previous crop, except for a few weeks in the beginning.

Those who deplore the fact that our soils are deprived of organic matter when we burn off cane trash, may find consolation in dwelling upon this hidden process by which some part of the chemicals we buy each crop goes to form several tons of cane roots, which decay and become a part of the reserve of organic matter. This is probably the safeguard that holds our agriculture upon a sound footing.

It was interesting in Formosa to see them piling cane trash in great mounds to be composted and returned to the soil. (Tea planters of that island went a step further in the interest of their soil. They cut grass on waste areas to make their compost heaps.)

A procedure of this kind, prohibitively expensive as a general practice under the labour wages paid here, may yet hold interest for small pockets of land where cane growth is poor through some fault of the soil.

It is frequently a subject of comment that sugar planting and stock raising have not become affiliated in some way to mutual advantage. But they have not; even corporations that have both ranches and sugar lands operate them independently of each other, making no use of cane tops for forage, or cattle manure for soil improvement. Does the future hold any possibilities in this direction?

Fifteen or twenty years ago a few plantations practised green manuring with Italian lupines, and one small place that used Mauritius velvet beans consistently, after two crops of cane, produced very cheap sugar. There are one or two plantations on Kauai that have what amounts to green manuring by a fallow that permits wild growth of leguminous weeds.

As a soil amendment, green manuring still deserves to be kept on the list, but there are to-day few instances in our sugar agriculture where it gains support.

We proceed now to chemicals that are used to correct some fault or unusual deficiency of the soil, rather than to supply the three common plant foods.

The use of sulphur by McGEORGE to render available iron or manganese in Kau areas affected with Pahala blight is an outstanding example of fertility amendment. The danger of using sulphur where it may do harm instead of good deserves emphasis.

At Olaa, experiments by CONANT and MOIR with manganese and copper salts deserve special consideration.

Stiff, puddled soils owe this condition to sodium and manganesium, and these bases may be replaced by calcium, in the form of gypsum, as at Waimanalo; or lime; or coral marl, as at Kekaha; or by calcium nitrate. The use of calcium nitrate for the double purpose of supplying nitrogen and improving the physical conditions in stiff soils has been advocated repeatedly by F. E. HANCE.

Between soil amendments and so-called plant stimulants, there is no sharp dividing line under our present knowledge, and mention should be made of the interesting results being obtained in several local experiments by the Pacific Guano & Fertilizer Co. and others, based on the findings of M. O. JOHNSON with chlorpicrin, the tear gas of military activities. As yet the cost of the treatment is very high, but even this obstacle does not mar interest in the surprising response in growth by pineapples, sugar cane, tomatoes and other plants. The Pacific Guano & Fertilizer Co. also obtains interesting results of like character with two other strange chemicals, dichloriodobenzene and pentathionic acid.

A good deal has already been said about the new concentrated chemical fertilizers, and fear expressed that in omitting the impurities of the older forms, we deprive the soils of something that they need.

That such a thing is possible may be shown by an experience, elsewhere than in these islands. Kainit, a low grade source of potash, was found to give plant growth far superior to more concentrated potash salts. Investigation showed that the soil was deficient in magnesium and that this lack was being supplied by the impurities of the kainit.

Many of our soils have too much magnesium, and kainit might be bad for them. Hence we should determine what our soils need and supply it in a suitable form, rather than to continue indefinitely to add, blindly, fertilizer impurities for the good they may, or may not, possess. And here we add other items to our schedule of research. In work along this line, L. E. DAVIS

found that of the rarer elements sugar cane showed interesting growth responses to manganese, titanium, copper and boron.

Apart from the need of adding the beneficial ingredients that our plants and soils require, there is the danger, in a programme of permanent agriculture, of inadvertently or unavoidably supplying harmful materials. Take our irrigation waters for example. It is not enough, as HANCE and McGEORGE have pointed out, to know merely the amount of chlorides, expressed as sodium chloride. Many of our waters are high in magnesium ; some contain fortunately, a good amount of calcium, others do not.

The potentialities for good or harm of everything that enters our soils should be understood or investigated ; whether in irrigation water, fertilizer, mill ashes, filter-press mud, molasses, or soil amendments of various sorts.

Is it too much to think that we should have adequate measures of the amounts and the composition of all these things—to anticipate a chemical control of our fields fashioned roughly upon the chemical control of our mills—an account of chemical compounds that enter the soil, and balanced against this, an account of those that leave in the cane crop ? Would the usefulness of such accounting be too greatly disturbed by lack of knowledge of what leaves the soil in drainage water ? (Is it feasible to estimate this in some practical way ?) Would such accounting pay its way ? Does it have a place in our effort to give permanent character to our agriculture ?

When we spend five or six millions a year for fertilizer, what fraction of this amount could be put to soil research to better understand all the chemistry involved and crop responses that follow ? If by better knowledge of what we are doing we could cut 10 per cent. from our fertilizer bills, or spend another million profitably, what is it worth to have this information ?

Fertilization for soil amendment and maintenance needs to be accompanied by all the information that the laboratory and field trial may throw upon it.

It is well to remind ourselves from time to time that in exporting sugar, we send with it none of the fertility of our soil, but only carbon, hydrogen, and oxygen that comes to us from the air and from the rain. This in theory appears to give the sugar planter an inherent advantage over the grain farmers and producers of other foodstuffs, for they must export from their land a part of its fertility as a part of their produce.

If the sugar planter could contrive to return his crop residues, he would go far toward maintaining his soil in a fertile state. If he cannot contrive to return them—if he finds it more expedient to burn them, or market them, or to let them go to waste, then he has need for his chemist to tell him what he must buy and give his soil in place of them.

For thereby he may hope to continue in the glorious privilege of maintaining the fertility of his soil " by making it produce big crops."

EUROPEAN BEET CROP ESTIMATE.—F. O. Licht's estimate at 30th September of the European beet crop of 1931-32 is as follows :—

	Hectares.	Metric Tons.
Europe without Russia	1,579,500	6,171,000
Russia	1,406,000	2,150,000
Europe including Russia	2,985,500	8,321,000

which, as compared with last year, implies a decrease or increase of :—

	Hectares.	Per cent.	Metric Tons.	Per cent.
Europe without Russia	—331,442	—17·3	—2,460,150	—28·5
Russia	+362,000	+34·7	+ 139,850	+ 7·0
Europe including Russia	+ 30,558	+ 1·0	—2,320,300	—21·8

Recent Work in Cane Agriculture.

COIMBATORE SEEDLING CANES : Co 281 AND Co 290 DESCRIBED AND ILLUSTRATED. **T. S. Venkatraman and R. Thomas.** *Agriculture and Livestock in India*, Vol. I, Part II, March, 1931.

These short descriptions and excellent illustrations will be widely welcomed. They are, in effect, a continuation of the descriptions on similar lines of five of the most popular Coimbatore seedlings in North India, Co 205 and Co 223 in the Punjab, and Co 210, Co 213 and Co 214 in north Bihar, published in January 1928[1]; and it is interesting to compare the two series and the progress made during the three years. The earlier group of seedlings have succeeded admirably in the purpose for which they were evolved, namely to replace the poor, thin canes which have for many centuries been grown on the two to three million acres under this crop in sub-tropical India : it is estimated that in about three years they will occupy most of this area. But they have their faults, especially in factory work in Bihar[2] and in few tropical countries where they have received some attention : and the two new canes now described bid fair to do away with these defects,[3] and will it is hoped form the vanguard of a new series of Coimbatore seedlings taking their place in the world's sugar industry.

Co 281. Parentage : Cheribon × Chunnee = POJ 213, Ashy Mauritius × *Saccharum spontaneum* (?) = Co 206, POJ 213 × Co 206 = Co 281.

Habit : erect, often a neat mass of practically erect canes, with the vinous or reddish vinous joints showing through the easily separating leaf sheaths. The lamina soon separates itself from the sheath except at the midrib, and hangs down, giving a characteristic appearance in the field. Deficiency of soil moisture is quickly indicated in this cane by an inrolling of the leaves. Foliage dark green, medium abundant. Leaf : lamina long, of medium width, erect with a short sharp curve near the tip. Sheath clasping cane loosely, with a marked tendency to self stripping, often with a broad scarious border in adult leaves, spines absent ; ligular processes absent or with a scarious indication on one side, ligule of medium width, slightly depressed above and distinctly depressed below. Cane : fairly straight, of medium thickness, nodes not projecting, roundish in section, solid. Colour vinous or reddish vinous, with prominent bloom bands, and bright yellow root zones, in old canes a distinct browning, including the root zone. Joints straight-sided, groove absent, ivory markings generally absent, weather markings sometimes pronounced, splits in moderate amount. Buds : small to medium, just reaching to growth ring, roundish or ovate, rather flat, flange inconspicuous with prominent black hairs near apex, buds bursting apically or near apex. Germination and early habit: soon after germination shoots are more or less erect, then slightly oblique, but at maturity practically erect. Set and shoot roots are compared with those of Chunnee and Hemja, two local north Indian canes . . . The adult root system is almost ideal for tapping both top and bottom layers of soil.

A cane of medium thickness, excellent habit, very early ripening and of high sucrose content ; not yet much used in India, but well suited to old exhausted soils in Cuba and to the peat soils of Florida : more resistant to cold than any of the POJ canes : very resistant to root disease, practically immune to leaf spot disease in Cuba, and susceptible but tolerant to mosaic. EARLE is quoted as asserting that its early maturing and the richness of its juice indicate its special value in sub-tropical climates.

Co 290. Parentage : Cheribon × Chunnee = POJ 213, Kaludai Boothan × *Saccharum spontaneum* (?) = Co 291, POJ 213 × Co. 291 = Co 221, Co 221 × D 74 or Kansar = Co 290. This cane has thus tropical cane,

1 *I.S.J.*, 1928, 237-240. 2 *I.S.J.*, 1929, 179-200. 3 *I.S.J.*, 1931, 434.

Saccharum Barberi, and possibly *Saccharum spontaneum* blood in it. Habit : erect or semi-erect, a rather loose mass of straight or slightly curved canes showing through the splitting and separating sheaths. Foliage green, medium abundant, certain of the leaves reverse themselves a little above half way, giving a characteristic mixture of upper and lower surfaces. Leaf : lamina long, of medium width, broadly curved below with a second sharper curve near tip when young, broadly curved when old. Sheaths clasping canes loosely and easily detaching themselves, the older sheaths with longitudinal splits often with purplish margins, spines varying but generally absent, ligular processes varying, indicated or present on one or both sides, often scarious and half an inch long, ligule prominent, arched above, depressed below. Cane : fairly straight and of medium thickness, nodes not prominent, roundish in cross section, with a narrow pithy central cavity when old. Ground colour glaucous green, with frequent blushes of purple or vinous purple, older portions greenish brown, fair quantity of bloom, occasionally heavily blackened. Joints straight-sided, groove practically absent, ivory markings absent, weather markings occasional or common, splits various. Bud : small to medium in young canes, sometimes swollen and brittle when mature, generally roundish, bursting nearly dorsal, flange conspicuous, rising about the middle, broad at sides and often retuse at apex. Germination : the shoots are slightly oblique at germination, but erect themselves about the fourth month. The set and shoot roots are compared as in Co 281 with those of local canes. Adult root system satisfactory, developing strong, thick and deep roots under good conditions.

A cane of medium thickness, with heavy individual canes, early maturing. In the United Provinces (where the bulk of the Indian canes are grown) this cane has shown itself superior to the other Coimbatore seedlings. The brittleness of the projecting buds requires careful handling. Highly resistant to mosaic. It is a "nobler" type than Co 213, and under good conditions is likely to do better than that cane. North Indian opinion is that this is the best seedling yet produced at Coimbatore.

Report of the Government Sugar Cane Expert. **T. S. Venkatraman.** Scientific Reports of the Imperial Institute of Agricultural Research, Pusa. 1929-1930.

Sugar Cane × Sorghum Hybrids.—The object aimed at in this piece of research is briefly stated as diminishing the length of the crop, to which is added the advantage of obtaining early ripening varieties for the factory. POJ 2725 was selected to cross with Sorghum, because it was a desirable kind of cane, it flowered abundantly at Coimbatore, and had no open anthers or fertile pollen. Crossed by Sorghum as male parent, plenty of seedlings were obtained, while no seedlings were obtained when crossing with other cereals.

The chief vegetative characters of these seedlings were as follows : (1) The first leaf is distinctly broader and shorter than those of other cane seedlings. (2) They were much more readily attacked by *Aphis maidis*. (3) In leaf module, surface, contour and presence of wax, they took after the Sorghum parent. (4) In fading some of them fold on the midrib instead of inrolling each half as in the cane, correlated with an interesting difference in structure. (5) Certain hybrids have a single row of root eyes in place of the two to four of the sugar cane. (6) Some develop "stilt" roots, the bud grooves extend the whole length of the joint, and some differ in shape and structure of the buds. These hybrids include a very wide range of forms, some being more like fodder grasses with a good amount of broad, soft leaves.

They ripen more quickly, some of them having already ripened in five months from planting out in the beds, instead of the ten to twelve months required by sugar cane seedlings. And their juice within this short period has shown over 16 per cent. of sucrose and over 85 per cent. of purity. The general look of the seedlings in spite of these characters is more like sugar cane than Sorghum ; and there has been no difficulty in propagating them by cuttings, an experiment having shown that this was also possible with Sorghum. They are lacking in tonnage, however, and to remedy this an attempt is being made to obtain more vigorous Sorghums and other vigorous growing cereals.[1]

Controlling time of flowering.—Fairly successful results have been obtained during the year, by differences in time of planting and manurial treatment. Phosphatic manures were found to hasten while organic and nitrogen manures to retard the time of flowering, and an interval of from twenty to thirty days from the usual time was thus bridged. At the same time it was thought advisable to obtain planting material from plots differently manured. It was found that plots manured with organic or nitrogenous manures gave distinctly better germination that those treated with phosphates.

In accordance with the programme of breeding work instituted last year, attention has been concentrated on Co 214, a cane with early ripening and great resistance to mosaic, but lacking in tonnage. In the attempt to improve it in this respect 95 per cent. of the selfed canes were devoted to it, about 14,000 having been planted out for a full year test.

Considerable attention was also devoted to the improvement of *root dissection technique*, in order to pick out the active part of the root system at any period, since in ordinary studies many of the roots examined represent older, conducting portions.[2] The method consists mainly in digging a vertical trench on one side of the cane plant, filling it with sand and keeping the sand moist to stimulate root development there. When the sand is removed, the main region of active roots becomes easily discernible. As a variation of this method a layer of thick soft cloth was placed vertically in the trench and the trench filled in as before. On removal after an interval the active roots are found enmeshed in the interstices of the cloth. The illustrations of the results of these experiments are highly suggestive.

THE POJ CANES AND INSECT DAMAGE. **U. C. Loftin.** Fourth Annual Proceedings of the Association de Technicos Azucareros de Cuba, December, 1930.

The introduction of disease resistant, large POJ canes marks a most important epoch in the history of cane growing in Cuba, and much interest has been felt in their relative damage by insect pests. While these canes have many individual qualities, they also have certain in common which distinguish them from such varieties as Cristalina, BH 10 (12) and SC 12/4. They are quicker in germinating have a stronger root system, withstand adverse conditions better, and in general have a more succulent and vigorous growth. These qualities influence insect damage, sometimes increasing and sometimes decreasing it according to the character of the insect. The following observations may be regarded as in the nature of a progress report, from which final conclusions cannot yet be drawn.

The moth borer, Diatraea saccharalis.—This is by far the worst pest, and the infestation and damage done by it have been studied for years past, in collaboration with a number of centrals. Two methods have been chiefly used, namely " Field tests " and " Carrier tests " : in the former a certain number of stools, usually four, of standing cane have been examined for

[1] *I.S.J.*, 1931, 433. [2] *I.S.J.*, 1929, 412-413.

borer holes, and in the latter 100 stalks have been selected at random from the carrier in the mill. A Table gives such weighted results of examinations by these two methods as are comparable, between the percentage of cane stalks attacked by borer in Cristalina, BH 10 (12), SC 12/4, on the one hand, and the POJ canes, 2714, 2725, 2727, 2878 and 2883. The general average of field and carrier tests are as follows: in 253 tests of the POJ canes the infestation was 39·7 per cent., and in 83 of the others 25·4 per cent. This of course does not necessarily mean that the POJ canes were more attacked, or that the damage done was greater; for the intensity of infestation, only to be judged by counting the *joints* with borer holes, and found to be directly correlated with the losses, was not available. But still there is a *prima facie* case against the POJ canes. Several factors have been observed as influencing the abundance of borers in the POJ canes, of which one is presented, in a record kept in a field at Baragua. In this field the varieties having the earliest germination showed the highest borer infestation at maturity. Thus, at ten days, the POJ's averaged 20 shoots and the others 3. The POJ plants were thus exposed to the moths on the wing before the others were through the ground, and their eggs were accordingly deposited on them, and the first generation of moths at any rate followed in due course. Another case, of a POJ 2725 newly planted field reported as being heavily infested, showed on examination, that it was surrounded by fields of Cristalina plants and ratoons which were suffering severely from the protracted drought, and that all moths emerging were concentrating on the fresh green POJ 2725 shoots.

The Stalk mealy bugs—Trionymus sacchari and Pseudococcus boninsis.[1] These are so wide-spread in Cuba, that one or both species can always be found in any field of canes. The damage, caused by sucking the juice, is slight unless the infestation is heavy. Very few data are available, but one observation at Baragua on first ratoons 5-8 months old is given. The percentage of infestation for the POJ canes in number order was 43·1, 28·1, 81·6, 67·4, and 40·0, and for Cristalina 46·5, BH 10 (12) 14·2, SC 12/4 40·0. Here the character of the leaf growth appears to be of importance. The upright, green leaves of POJ 2727 (81·6) and POJ 2878 (67·4) provided the best conditions for the mealy bugs; whereas POJ 2725 (28·1) and BH 10 (12) (14·2), with more open growth, had the fewest. The green fungus, *Aspergillus sp.*, is parasitic on these mealy bugs, and is a very important natural means of control; and suitable environment for the growth of this fungus may have as much influence as favourable conditions for the mealy bugs themselves.

The Root mealy bug or Grass mealy bug, Ripersia radicicola,[2] is a more serious pest, and congregates in large numbers on the underground parts of the cane and especially on the lateral roots. Small areas of old ratoons are killed outright, and it becomes extremely difficult then to secure a stand by replanting. It has however been often noted that the POJ varieties will make a satisfactory stand where other varieties completely fail to do so This mealy bug does not attack leguminous crops, and very good results have been obtained by putting such a crop in before replanting with POJ canes.

Wireworms.—These are always more severe in their attacks when some other unfavourable condition is present, as drought or poor soil conditions. They feed upon the roots, and when very abundant prune them off as fast as they are formed. A healthy, fast growing plant, can however support a remarkably large colony of wire-worms without noticeable injury, whereas a weakened plant quickly succumbs. In this respect the POJ canes, and especially POJ 2725 and 2878, have a great advantage over Cristalina, in that

1, 2, *I.S.J.*, 1927 (with illustrations).

germination is quicker and the root development much stronger. A small plot of grass sod was broken and planted with eight varieties of cane at Baragua for the study of root development. The young plants did not thrive because of the dryness of the soil and injury by wireworms ; but POJ 2725, 2727 and 2878 did much better than the other five. It is in fact obvious from the details given in this paper that a comparison of different varieties as to injury from insects is a very different proposition to varietal susceptibility to disease. It is a much wider subject, and all sorts of environmental conditions have to be taken into account, let alone the greater mobility of the insect and the path that it takes in its objective : some part of this choice is passed on to diseases where insects carry the spores of fungi with them, and more when they actually share in the damage, as in virus diseases.

THE AGRICULTURAL MANAGEMENT OF SOME IMPORTANT SOIL TYPES. PART II. **J. A. Faris.** Fourth Annual Proceedings of the Association de Technicos Azucareros de Cuba, December, 1930.

In Part I of this series of articles, FARIS described three soils, the Matanzas Clay. Truffin Clay and Alto Cedro Clay.[1] But before doing so he gave a short analysis of the recent important classificatory work of BENNETT and ALLISON on Cuban soils. In the present paper, before commencing his descriptions, he gives a summary of the geological origin of the soils of Cuba, as necessary to clarify our conceptions of them. Briefly, they may be traced to three sources: volcanic rocks, limestone and chalky ones, and mixtures of these two more or less through alluvial deposition ; besides there are smaller areas of purely organic nature such as peat and muck soils.

(1) Volcanic soils, usually found in the Limones family of which one is described later on. There is no free lime in these soils, although a whitish layer of decomposed rock near the parent rock may be confounded with it. The soils are formed from the disintegration of igneous and serpentine rocks ; when dry they shrink and crack to clods difficult to reduce so that they dry rapidly and deeply, cane usually suffers during dry periods : even in normal seasons the plants wilt during ripening ; and besides this there is a tendency to form a powdery layer, two to four inches thick, and this causes them to be more droughty. The more organic matter incorporated during cultivation the better. These soils usually border sabana and the foot hills of mountain areas, and show large tracts under pasture in Santa Clara, Camaguey and Oriente. Continued burning of the canes reduces their fertility and water-holding properties, so that the number of ratoons is reduced ; three to six is considered good for Cristalina.

(2) Decomposition of limestone or chalk in situ, forming two classes according to the age of the deposit.

(*a*) The oldest and more fertile are from limestone laid down on the bed of the ocean, sometimes forming rock and at others a granular layer of chalk called *coco*. This group includes some of the best cane and vegetable areas in the Camaguey Clay, Santa Clara clay, and Havana clay.

(*b*) Recent coralline formations, from which are derived the Matanzas clay and Fransisco clay. The former is the residue of porous limestone from which the lime has been dissolved out, leaving behind the reddish soil material. The soils are usually porous at the top, but in the Fransisco soil there is an impervious subsoil, so that when it is shallow, there is danger of water logging in the rainy weather.

1 *I.S.J.*, 1930, 524.

(3) The third group of soils, formed from a mixture of those derived from limestone and serpentine, makes up very large areas from the outwash of the serpentine and limestone hills. These soils vary very greatly because of their mode of origin, in many cases being mixed in the sea and brought up by elevation, after which the soils are formed by the decomposition of the surface layers and mixed with organic materials. Very good examples of such soils are Chaparra clay and considerable areas of the Alto Cedro clay.

These wide differences in origin are taken into account in the classification of soil into large groups, such as orders and families ; and when a soil can be placed in one of these groups its identification becomes easier among the several types, and it is of first importance in agriculture to effect such identification. The plantations in Cuba are so large that it is not possible for any one man to be acquainted with the details of each field ; but a vast amount of agricultural knowledge has been accumulated ; and when this is interpreted in relation to the soil type, it will be of value wherever the soil type is found. And this may be assisted by the use of soil maps.

The families described in this Part II are the Santa Clara clay, the Havana clay and the Limones clay ; the first two and the previous three arising from limestone, chalk, etc., and the last from residual serpentine rock. The present series are generally undulating, and therefore have sufficient surface drainage. But they are also liable to erosion, both from the fineness of their particles and the broken topography, and this must be seriously considered. Recent work in Missouri indicates that in open cultivation erosion takes place from 50 to 300 times as fast as in grassland, while with covering crops such as clover it is 10 to 20 times as fast. And this obviously suggests the importance of incorporating the trash in cultivation : already barren hill tops are appearing in parts of Havana, and contour planting of the rows is receiving attention.

4. Santa Clara Clay.

This family is characterized by moderately stiff clay subsoils which may harden and crack upon drying but which can be got into good tilth rather easily. The type under discussion occurs in small and large areas in a great many parts of the island, is characteristically undulating and rolling, and is always underlain by limestone or chalky *coco*. The soil profile commences with 8-12 ins. of brown clay, overlying brownish to yellowish moderately stiff clay when drying, both layers having free lime scattered through. At 18-30 ins. it passes to a calcareous clay with lumps of soft white lime or fragments of limestone, and overlies white chalky lime (*coco*) or beds of limestone. On drying it breaks down to fine, small or medium clods of only moderate hardness : the clay cracks more than Matanzas clay but conserves moisture better. Gravelly or stony patches occur at higher levels and there is *perdigon* in minute quantities.

This is one of the best cane soils in the island, with high tonnage and sucrose : holds moisture and ripens cane well, and drains well. It is friable and in demand for vegetables and tobacco.

5. Havana Clay.

This family is characterized by friable soils, owing to the flocculation of its chalky lime, besides silt in alluvial areas. The soil profile of the series is as follows : highly calcareous ashy gray soil, mostly clayey, crumbling well when dry ; at 5-8 ins. passing into ashy brown or yellowish friable calcareous clay ; and at 10-12 ins. to cream coloured or whitish chalky lime . . . In places the second layer has slabby limestone interstratified with *coco*, and some fields have limestone fragments scattered over them, called *lajas*. Agricultural

characters are similar to the last, but more liable to erosion for the soil is thin and loose and much has been abandoned. In some cases the *coco* seems to have some deleterious substance, for the canes die out in patches. This soil is widely distributed in the hilly parts of Matanzas, Havana and Santa Clara, and is also present in considerable quantity in Camaguey and Oriente. In the latter provinces good cane crops are reaped, as the effects of erosion have not yet appeared, because of the more recent extension of cultivation there.

6. Limones Clay.

This family of soils is in marked contrast to those hitherto discussed, being shallow clays from residual serpentine rocks. They are characterized by stiff subsoils which become dried up and crack badly, forming clods which are difficult to reduce; there are also considerable areas with *polvillo* surface, very loose and droughty. The soil profile shows a typical three horizon character : (1) 3-5 ins. dark red or purplish red clay, cracking on drying to very hard clods (2) pinkish red clay cracking to very hard clods, with some portions of partly decomposed parent rock (3) at 12-20 ins. partly decomposed soft and hard rock, mostly serpentine and diorite. This soil has no free lime, although almost always alkaline in reaction : there is often a chalky looking layer of decomposed rock near to the parent rock, which may lead to confusion.

Rather poor for sugar cane, practically " marginal land," only to be cultivated when sugar price is high. Agriculturally there are difficulties ; when dry it is very difficult to plough and when wet so sticky as to be unworkable. The tendency to dry quickly and deeply when rains cease limits the time when the land can be prepared, and germination is unsatisfactory. There are indications that the new varieties give better yields on these soils ; but at the present time, it is inadvisable to enter on sugar cultivation without very rigid accounts of cultivation costs being kept. Such soils are obviously better laid out for pasture.

C.A.B.

" **Lystonol.**"—This is a particularly powerful immunizer, which has been found of much value both in the beet and the cane sugar industries for the preservation of juices, syrups, molasses, sweet-waters, and the like, against fermentation. In the beet sugar factory, micro-organisms develop during the process of diffusion causing the formation of gas, and at the same time inverting some of the sucrose present. In this way the circulation of the juice through the battery may be slowed down considerably, and the normal working of the factory thus much affected. Addition to the battery of " Lystonol " at the rate of about 20 grms. per ton of beets has been found effectually to prevent this fermentation, so as to allow diffusion to proceed smoothly. That the use of " Lystonol " in this way is effective is proved by the large number of testimonials from French, Belgian, Spanish, Portuguese, Dutch and Bulgarian sugar factory managers, which are published by the Manufacturers, the Laboratoires de Chimie Appliquée, of 10, Rue du Cardinal-Mercier, Paris. Some of these states that previous to its use the factory had suffered from a considerable retardation of the rate of circulation in the diffusion battery, due not to bad cossettes, nor to over-heating, but to fermentation. Bisulphite did not help matters much ; but few hours after commencing the addition of " Lystonol " the battery was completely disinfected, a very rapid circulation then being obtained. Mr. J. ZAMARON, whose name is known to most sugar chemists, supports the claims made for the preparation, pointing out that on one occasion during a stoppage the evaporator syrup treated with " Lystonol " had kept for 18 hours perfectly without the slightest deterioration or formation of glucose. It is a product which should be found of service in the cane sugar industry as well.

The Sugar Trade in India during the Year 1929-30.[1]

According to the Final General Memorandum of the Indian sugar cane crop of 1929-30,the area planted with sugar cane is estimated at 2,504,000 acres, as compared with 2,568,000 acres in 1928-29, and the yield of raw sugar (*gur*) is put down at 2,766,000 tons, against 2,568,000 tons in the preceding year. These figures are exclusive of crops grown on a small scale in sundry other tracts of India, the average of which for the last five years comes to about 109,000 acres in all, yielding about 120,000 tons of sugar. Out of the 2,504,000 acres above mentioned, the greater part comes from the provinces of U.P. (more than 50 per cent. of the total), Punjab, Bihar and Orissa, and Bengal.

The cultivation of improved varieties of cane has continued to increase, the area under such varieties having been 549,025 acres in 1929-30, as compared with 301,098 acres in the previous year.

The net production in India of *gur* and *jaggery*, both cane and palm, during 1929-30 may be put down at about 2,244,000 tons. Some portion of this product is used up as *gur* or *rab* in modern refineries and in the indigenous process of sugar manufature.

The production of *refined sugar* by factories working direct with cane amounted to 68,050 tons during 1928-29, 89,768 tons during 1929-30, and 119,859 tons in 1930-31. In 1928-29 the modern refineries working with *gur* turned out 31,038 tons of sugar. Adding the *deshi* sugar manufactured by various processes (estimated by the Indian Tariff Board at 200,000 tons), the total production of sugar in 1928-29 may be taken at 299,088 tons. Figures of later years are seemingly not yet available.

India's imports of foreign sugar of all kinds, excluding molasses, amounted to 939,600 tons in 1929-30, as compared with 868,800 tons in 1928-29. The increase indicated was specially due to the greater import of beet sugar, totalling 131,000 tons, of which the United Kingdom supplied 45,000 tons and Hungary about 34,500 tons. Sugar from Java was imported to the amouut of 781,100 tons (as against 850,800 tons in 1928-29).

The above statistics show that India's production of refined sugar is at present only about 300,000 tons against her consumption of 1,325.230 tons, that is for about 77 per cent. of her requirements of sugar she has to depend on foreign supplies, mostly from Java. Yet India enjoys now a protection of Rs. 6 per cwt. or over 100 per cent. on the landed cost of sugar at Calcutta. The output of white sugar from central factories has expanded only slowly having increased from 23,620 tons in 1922-23 to approximately 120,000 tons in 1930-31.

A more hopeful sign of progress is to be found in the increased efficiency of the factories. The following table shows that the recovery of sugar (average for India) has increased from 8 per cent. to over 9 per cent. during the past five years. Out of 29 factories that worked in India during 1930-31, the percentage recovery at 2 factories was over 10, at 12 factories over 9, at 11 others over 8, and at only 4 below 8 per cent.

RECOVERY OF SUGAR PER CENT CANE (AVERAGE FOR INDIA).

Year.	Recovery per Cent.	Year.	Recovery per Cent.
1925-26	8·07	1928-29	8·59
1926-27	8·49	1929-30	9·07
1927-28	8·62	1930-31	9·09

1 Based mainly on the Report by Mr. R. C. SRIVASTAVA. Sugar Technologist of the Imperial Council of Agricultural Research, Cawnpore, appearing in the *Indian Trade Journal*.

Java Technical Notes.

MOLASSES AS A FERTILIZER. **Anon.** *The South African Sugar Journal*, **1931**, **15**, No. 8, 521-523.

One of the most interesting experiments on the use of molasses as fertilizer, of which we have recent information, was made in Java, and consisted in ascertaining to which of the constituents of the molasses the fertilizing action was due. The soil chosen was a sandy one, as from former experiments it was already known that a manuring with molasses therein had been a success. Its analysis was :—

PHYSICAL ANALYSIS :—

Gravel, 2 mm.	6·200
Water content at 135°C.	3·170
Hygroscopicity	3·760
Classification (Williams)	No. 1

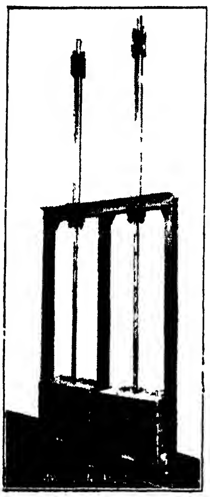
CHEMICAL ANALYSIS.

Organic matter	0·400
Nitrogen in organic matter	4·800
Nitrogen total	0·019
Phosphoric acid, P_2O_5 in 25 per cent. hydrochloric acid	0·147
Phosphoric acid, P_2O_5 in 2 per cent. citric acid	0·091
Potash, K_2O, in 25 per cent. hydrochloric acid	0·041
Potash, K_2O, in 2 per cent. citric acid	0·026
Lime in 10 per cent. ammonium chlorine	0·210

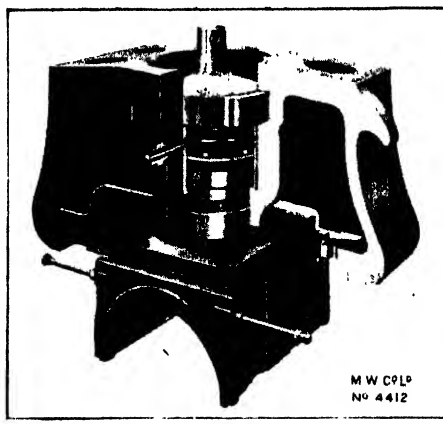
All plots received the ordinary quantity of sulphate of ammonia, giving the highest yield in these soils, viz., 250 kg. per acre. Others received in excess in every row of 30 ft. long, two kerosene tins (about 5 gallons) of molasses of 25° Brix., diluted in half this volume of water, as a preliminary manure, equivalent to 10 tons of molasses per acre, one month before planting. Another series received the sugar contained in the molasses as a pre-manuring, viz.: 7 kg. dry centrifugalled molasses sugar, diluted in water, per row of 30 ft. as an extra manure, or say, 1920 kg. per acre. A further series received extra nitrogen equivalent to the nitrogen in the molasses, added to the ordinary quantity of sulphate of ammonia, viz. 75 grms. of sulphate of ammonia added per row, equal to about 20 kg. per acre, more or less a month after planting. The last series received, besides the extra nitrogen, also the extra potash contained in the molasses, being 6·5 grms. sulphate of potash per row of 30 ft., equal to 185 kg. of sulphate of potash per acre, given one month after planting. In both years each series consisted of eight parallel plots. The coincidence of the results obtained in both years is striking; the constituent of the molasses, to which is due the best yield in cane and sugar per acre, is the sugar. The molasses plots yielded 11 to 12 tons of cane per acre more than those manured in the ordinary way. The corresponding excess in the sugar plots was 6·5 tons; the extra nitrogen plots 2½ to 3½ tons, and the extra nitrogen and potash plots 3 to 4 tons per acre. The influence of the different constituents on the yield in sugar follows in the same way; manuring with liquid molasses causes the available sugar in the cane to decrease considerably; while manuring with solid sugar has a like effect, though much less considerable. The superior quality of sulphate of ammonia and potash have also shown a small set-back in the available sugar content in the cane. It would be very advisable to repeat these trials on similar soils, with more control plots, especially with a view to observing the effect

Mirrlees'

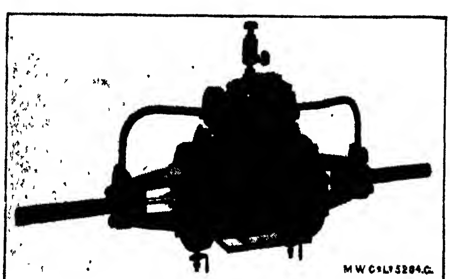
HYDRAULIC REGULATORS and ACCESSORIES for CANE MILLS.



TWIN ACCUMULATORS.



HYDRAULIC CAP.



STEAM PUMP.

HAND PUMP AND TANK.

The MIRRLEES WATSON COMPANY LIMITED

ENGINEERS, SCOTLAND STREET, **GLASGOW.**

London Office - Mirrlees House, 7, Grosvenor Gdns., S.W.1.

0.55

of the potash. The series Nos. 2 and 3 show approximately the same yield of sugar per acre in both years, but the preference should altogether be given to No. 3, because in this case the superior quantity of sugar is obtained by milling a smaller quantity of cane.

RELATIONSHIP OF THE COOLING SURFACE TO THE CAPACITY OF CRYSTALLIZERS. **P. Honig and W. F. Alewijn.** *Proefstation voor de Java-Suiker-industrie, Mededeelingen,* 1930, 40-43.

In air-cooled crystallizers the surface which is cooled can be divided into two parts : where the massecuite rests against the wall of the crystallizer, and where the massecuite is in contact with the air. Regarding the first, the cooling of the wall surface, this is of course affected to some extent by the situation, whether it is close to the other crystallizers of the battery, and whether there is any circulation of air through the intervening spaces, this having a distinct effect. As for the second, this is influenced by the form of the apparatus, by the movement of the exterior air, and by the circulation of the contents. The proper cooling to room temperature of massecuites in air-cooled crystallizers requires considerable time, viz., 100 hours and more. In fact it never happens in Java factories, and only in other countries are molasses massecuites cooled longer than five days, their temperatures thus falling to about 30°C. In order to increase the crystallizer capacity, the exterior of the apparatus is sometimes water cooled, that is, cold water is allowed to flow over the outer walls ; but the advantage of so doing must be considered very slight. This is due partly to the relatively small cooling surface, and partly to the low heat transmission, due to the poor circulation of the massecuite against the walls.

But, by providing the crystallizer internally in some way or other, with cooling surfaces, numerous examples of which have been described, cooling is enabled to take place in a short space of time, the heat of the strike being removed in the cooling water. Investigations with the Lafeuille apparatus show a cooling down of 30°C. in 1½ to 2 hours ; while with the Werkspoor crystallizer about 25°C. in 2½ hours. In general high purity massecuites can be submitted to such a rapid cooling without too great a supersaturation taking place or without the formation of secondary grain ; but with massecuites of lower purity, it appears that often a period of only 1½ to 2 hours is too rapid, the rate of crystallization not being great enough to precipitate from solution the sugar present in the super-saturated state. Then the supersaturation may rise to a considerable degree. Such low purity massecuite should be cooled in crystallizers having a smaller internal cooling surface, which crystallizers are anyway cheaper than those in which a large cooling surface is employed. Assuming the rate of cooling in the Lafeuille apparatus to be 1½ hours, and taking the average specific heat of massecuites to be 0·37, then on cooling to 30°C., the heat carried away per hl. of massecuite of 92° Brix is equivalent to : $1 \times 100 \times 1{\cdot}5 \times 30 \times 0{\cdot}37 =$ about 1665 calories, or 333,000 from a strike of 200 hl., or 3700 per min. Comparing now the Werkspoor, which cools off 180 hl. in 2½ hours with a drop of 25°C., the heat carried off is : $1 \times 100 \times 1{\cdot}5 \times 25 \times 0{\cdot}37 = 1{,}387$ per hl., or 24,975 for the 180 hl., or 166·5 calories per minute. This difference is due to the larger cooling surface of the Lafeuille, viz., 150 sq. m. per 200 hl. nett capacity ; whereas the Werkspoor has only 60 sq. m. of water-cooled surface, though, due to the counter-current principle, it is made use of more effectively than in the other apparatus.

HOT LIMING APPLIED AT PANGGOONGREDJO S.F. **A. Bussemaker.** *Archief*, 1931, **39**, I, No. 4, 69-81.

During the 1929 campaign, especially in the first four weeks, difficulty was experienced in turning out an acceptable white sugar at Panggoongredjo s.f. It had a greenish tinge. This was more marked in the molasses sugar, which in fact could not be sold unless covered with caramel and rhodamine, Efforts were made to improve the clarification of the juice in different ways, as, for example, by the use of infusorial earth, which was added to the cold juice in amounts of as much as 5 per cent. of the Brix; or by adding the lime to the Boulogne weighing apparatus, before running in the juice, so as to secure a sufficient admixture. But it was impossible to effect any appreciable improvement in the colour of the products. Now, it had been noticed in the determination of the CaO requirement of the raw juice by *hot* titration with lime-water, a better clarification always resulted than in practice in the cold. Also that when the boiling raw juice was added to the measured amount of milk-of-lime in a beaker, a lighter coloured clarified juice was obtained than when the boiling raw juice was treated drop-by-drop with the same quantity of milk-of-lime. A factory experiment was therefore carried out in such a manner that during the filling of the subsiding tank the milk-of-lime was mixed as well as possible with the inflowing hot raw juice. Working in this way, it was noticed that clarified juice was obtained which was clearer, that a very voluminous precipitate resulted, and that the amount of lime used was more than in the cold to reach the same pH, viz., **6·9**.

Some glucose decomposition had taken place; but later it was found that, by mixing the hot juice with the milk in such a manner that the alkaline reaction was instantaneously overcome, this could be obviated. It being quite impossible on the large scale to mix 3-4 litres of milk with 1000 of juice, so as to temper in a second, it was decided to try to use a proportion of the raw juice for the formation of calcium saccharate, viz., 10 per cent., the remaining 90 per cent. of juice being heated to boiling point. Tests were made in the laboratory initiating this method of working, and these were quite successful. A saccharate solution of 3 per cent. (3 litres of milk at 15°C. per 100 litres of raw juice) was prepared, and in order to effect continuous admixture so far as possible, the saccharate solution and the hot juice were simultaneously poured into a beaker in such a way that the two jets crossed one another. A light-coloured, almost sparkling juice without glucose decomposition was the result. Later the factory plant was so designed as to permit almost instantaneous admixture in this system of hot liming; and the results with it were satisfactory in every way compared with the cold method. All the advantages of a particularly well clarified juice were observed, such as cleaner evaporator tubes, easier boiling, and better centrifugal work. Covering of the sugar could be performed with less water, and it was easy to maintain the satisfactory colour of the sugar, No. 22, for example, being made without any trouble. That a much superior method of clarification had been discovered was evident above all from the quality of the molasses sugar, which was now golden-yellow with no tinge of green.

FORMOSA CROP ESTIMATES.—According to British Consular advices, the first official forecast of the 1931-32 sugar crop in Formosa indicates an output of 893,123 long tons of centrifugals (including "plantation whites") and 12,164 tons of browns, making a total of 905,287 tons. This represents an increase of 120,955 tons over the actual crop harvested during 1930-31 and of 107,636 tons over that of the record season of 1929-30. This rise in production is the result of an increased area planted and of the introduction of better varieties of cane.

Abstracts of the International Society of Sugar Cane Technologists.

Under the scheme instituted by the I.S.S.C.T. a collection of abstracts of papers on agricultural and technical subjects is prepared monthly. A selection from these " Sugar Abstracts " has been made by us, and appears below :—

BEET SUGAR MANUFACTURE.

A NEW SUGAR DRYER. **Büttner-Werke A.-G.** *Centr. Zuckerind.*, 1931, **39**, 784-786.

Designed to subject the sugar to the least possible abrasion during its passage through the apparatus, it consists of a series of annular shelves, one above the other, which rotate about a common axis. The sugar to be dried is spread by a distributor in a thin layer on the revolving upper shelf ; when the shelf has almost finished one revolution the sugar is automatically scraped into a slit through which it falls to be evenly distributed over the next lower shelf ; and so on to the bottom shelf. Within the annular space formed by the shelves are one or more fans of special construction, which circulate heated air through the shelf space.

INFLUENCE OF TEMPERATURE ON AFFINABILITY OF RAW BEET SUGAR. **O. Spengler and A. Traegel.** *Zeitsch. Ver. deut. Zuckerind.*, 1931, 81, 289-299.

Samples of raw beet sugars were stored at 20, 30, 40, 50 and 60°C. for periods of 8 hours to 3 weeks under otherwise uniform storage conditions, and were thereafter subjected to the standard affination test. Storage at temperatures over 40°C. resulted in impairment of both the affining quality and the colour of the sugar. These experiments are considered to show the importance of thoroughly cooling raw sugars before sending them to storage. Sugar bagged at temperatures between 35 and 45°C. when stored in large piles will retain these temperatures for several days and in this time may easily fall in colour value. This depreciation will be avoided if the sugar is cooled below 30°C. before going to storage.

KIESELGUHR IN THE BEET SUGAR INDUSTRY. **G. Hruda.** *Deut. Zuckerind.* 1931, **56**, 507-508, 535-538.

Operating data relating to the use of " Hyflo " were collected from nine of the factories of the G.W.S. Co., and from Crockett Refinery, and statistical analyses were made by the company's accountants. These showed cash savings arising from greater filter capacity, less labour, lower filter-cloth and sulphur consumption, and reduced mechanical sugar losses ; and the money value of these savings more than covered the cost of the filter-aid and its application.

SOLUBILITY OF LIME IN SUGAR SOLUTIONS. **E. Landt and E. Saalmann.** *Zeitsch. Ver. deut. Zuckerind.*, 1931, **81**, 361-377.

This is a review of the investigations of VAN AKEN on the solubility of lime in sugar solutions, which lead to the following conclusions : Particles of lime introduced into a sugar solution adsorb sucrose on their surfaces and thereby become peptized. The degree of dispersion thereby occasioned depends on the amount of added lime concentration of the sugar solution, the temperature, and other factors.

FRENCH BEET MOLASSES OF 1930-31. **E. Saillard.** *Suppl. Circ. hebd.*, No. 2206 of 1931.

Average results of the analysis of 62 samples from as many factories made in the author's factory are as follows : Dry substance, per cent. 76·11 ; Pol. direct 49·3 ; Clerget sugar, per cent. 45·53 ; True purity 64·66 ; Sulphate ash × 0·9, 9·24 ; Salt quotient 5·29 ; *pH* 6·3 ; Lime salts, per cent. 1·4 ; Colour 3·10 ; Nitrogen 1·65 ; and Organic substance/ash 1·93. Nearly all these molasses contained more than 20 per cent. of water, but there was one notable exception in which the water content was 15·75 per cent. and the true purity 63·10. This example shows that molasses can be well exhausted without adding excessive amounts of water to the massecuites and low grade products. The nitrogen content, 1·95 per cent., is the lowest on record in France, but the difference between the direct and Clerget polarizations, 1·78, is the highest on record.

CANE SUGAR MANUFACTURE.

COLLOID CONTENT OF CANE MILL JUICES. **M. R. Monsould.** *Philippine Agriculturist*, 1931, **20**, 53-74.

A total of 156 determinations of the colloid content of mill juices of a Philippine sugar central was made either by the dye test or the ultramicroscope cataphoresis apparatus. The dye value of the crusher juice averaged 674, with variations ranging from 331 to 1191. Within certain limits, the greater the quantity of maceration water employed, the greater was the colloid content in the 2nd, 3rd, and 4th mill juices. Dye value determinations on the mixed juice and the clarified juice indicated that, on the average, 15·55 per cent. of the colloidal matter was removed by the lime defecation process employed at the mill where the tests were made ; the minimum was 9·98 and the maximum 32·24 per cent. for the period. To a certain extent, the addition of maceration water produced more colloid in the juice, but this disadvantage was offset by the higher sucrose extraction brought about by efficient maceration.

ALCOHOL AS AUTOMOBILE FUEL. **W. E. Cross.** *Rev. Ind. Agr. Tucumán*, 1931, **21**, 5-19.

Among the technical advances is the demonstration that high compression is unnecessary in alcohol motors. Experience in many countries has shown that when alcohol is mixed with gasoline " knocking " is greatly reduced, no carbon is deposited, the motor heats up less, there is less consumption of lubrication oil, more power is developed, and there is an increase of mileage per litre of fuel. The manufacture of absolute alcohol by the azeotropic process has been improved and simplified, and the use of alcohol in motor fuel has been made compulsory in many countries. The aviation branch of the United States Navy has approved a mixture of 70 per cent. gasoline and 30 per cent. absolute alcohol as a fuel for airplanes. For common use alcohol of 95 per cent. is used in mixture with ether or with gasoline and benzol, but on the whole it is more satisfactory to use mixtures of absolute alcohol and gasoline. Measures for promoting use of alcohol are : (1) A simple method of denaturing and the sale of denatured alcohol without restrictions ; (2) a requirement that all imported petrol be mixed with a certain proportion of absolute alcohol before being placed on sale ; (3) fiscal measures to make it possible to sell alcohol in competition with petrol ; and (4) Bonuses, tax exemptions, etc., to the manufacturers of fuel alcohol.

JAVA FUEL RESULTS 1930. *Archief*, 1931, **39**, III, *Mededeelingen*, No. 15, 633.

This report contains fuel data from 170 factories in Java, which are averaged as follows :—

Kind of Factory.	Number of Factories.	K. Cal. per Kg. Brix in Raw Juice consumed.	available in bagasse.
Defecation	51	3395	3347
Sulphitation	66	3605	3272
Carbonatation	53	3426	3339
All together	170	3482	3316

Calculated on all factories, the consumption of heat calories per kg. Brix. in raw juice was somewhat lower than in 1929 ; the total calories available in the bagasse was somewhat larger than in 1929. The amount of supplementary fuel required shows a decrease of from 8 to 6 per cent., which was covered by the use of cane trash. This refers to the average result. Some factories had to buy wood, while others had a surplus of bagasse.

MULGRAVE MILL RESULTS, 1930. *Annual Report, Mulgrave Central Mill Company*, 1931.

The manufacturing records of this Australian raw sugar factory show the following milling data : average cane crushed per hour, 63 tons ; average extraction at mills 95·04 per cent. ; sucrose in final bagasse, 2·92 per cent. ; moisture of final bagasse, 54·15 per cent. ; commercial cane sugar in cane, 15·03 per cent. ; fibre in cane, 11·37 per cent. ; true purity of final molasses, 46·5 ; cane per ton of 94 nett titre sugar, 6·857 tons ; average cost of cane per ton sugar, £15. 2s. 11¾d.

EXAMINATION OF SYRUPS IN WOOD'S LIGHT. **G. Mezzadroli and E. Vareton.** *L'Ind. Sacc. Ital.*, 1931, **24**, 254-257.

The various pure sugars—sucrose, levulose, glucose, raffinose, lactose, and mannose—are readily distinguishable one from another by their different fluorescence in WOOD's light, whether examined in the solid state or in aqueous solution. The authors have examined a large number of sugar syrups and grape, orange and lemon syrups, alone and in mixtures, and describe the fluorescence observed in each. Imitation and adulterated fruit syrups can be detected in many cases.

STUDIES ON TURBIDITY. **F. W. Zerban and Louis Sattler.** *Industrial and Engineering Chemistry (Anal. Ed.)*, 1931, **3**, 326-330.

Previous work is briefly reviewed. The Pulfrich photometer, with which both the transmittancy and the Tyndall beam intensity of turbid solutions can be determined, is described. It was found that with coloured turbid raw sugar solutions the Tyndall-beam intensity is affected to such an extent by absorption that the latter must be corrected for. The ratio between Tyndall beam intensity and transmittancy is, within a certain range, a power function of the depth or the concentration, according to the formulas : $R = R_1 \times b^n$, and $R = R_1 \times c^n$, where b is the depth, c the concentration, R_1 the ratio for unit depth or concentration, and R the ratio at any depth or concentration ; n is a constant which, at constant depth and varying concentration, or vice versa, is independent of wave length. In the formula $R = R_1 \times b^n$, the value of n varies approximately as the logarithm of the concentration. This work on turbidity is being continued, and another paper will be published shortly.

Publications Received.

The Digestion of Grasses and Bamboo for Paper Making. W. Raitt, M.I.Chem.E. Pp. xi + 116 with 20 plates. (Crosby Lockwood & Sons, London). 1931. Price : 21s.

Chapters : I, Introductory. II, History of Pulping. III, Grasses. IV and V, Analysis. VI, Plant Nutrition and the Ligno-Cellulose Complex. VII, Autoclave Practice. VIII, Digestion Problems. IX, Digestion Systems. X, Bamboo, its Occurrence and Growth. XI, Bamboo, its Chemical Constitution and Physical Characteristics. XII, Manufacturing Facilities and Transport. XIII, Microscopical Features of Bamboo. Index. Those contemplating the utilization of bagasse or like graminaceous material for paper making should find in this book much pertinent practical information on the art. Its author, formerly Cellulose Expert to the Government of India, was engaged for twenty-five years on investigating the possibility of using bamboo for paper pulp production, and was successful in discovering a method of "fractional digestion," which cleared away many difficulties. Boiling for the isolation of cellulose is here shown to be an operation calling for careful chemical control, one being told what happens at each stage of digestion, and how these stages can be most economically carried out in the mill. There appears to be little doubt from a perusal of the pages of the book that the use of bamboo for paper making has been established technically. It is printed with its excellent illustrations on bleached bamboo paper, and a specimen page of the unbleached pulp of the same material also appears.

The Chemistry, Flavouring and Manufacture of Chocolate, Confectionery and Cocoa. H. R. Jensen. With 23 Illustrations. (J. & A. Churchill, London). 1931. Price : 27s.

This is a book which everyone engaged in the chocolate, confectionery and cocoa industries (and not only their chemists) would do well to possess, so large is its store of useful practical information, general and specialized. Its contents show to what an extent these long established manufactures now depend for economical and efficient operation on scientifically conducted processes; and show also that there is ample scope for the activities of the well-equipped chemist. Much useful information is presented on cacao, chocolate and cocoa powder, and some of this is of a general nature. It presents a particularly good account of confectionery fats, sugar and milk products, and agglutinants. Its chapters dealing with flavouring and colouring contain information not to be read elsewhere, and will be found very useful to most readers. There are also some practical analytical notes, which well reflect the author's experience in the laboratory, and these, particularly where dealing with arsenic determinations and iodine values, should be found specially serviceable. It is a good book that will, we predict, prove of permanent value to those working in the industries concerned.

Kingston's Price Equivalent Tables. (*a*) Per Lb. and Kg. ; (*b*) Per Yard and Metre. (Kingston's Translations Institute, 96, Leadenhall Street, London). 2s. net each.

These are useful Tables extending from ⅛ penny to 20s. per lb. or yard with equivalents in the currencies of Belgium, Denmark, Estonia, France, Germany, Holland, Italy, Latvia, Sweden and Switzerland, and are printed on 8-page folding cards.

Hints for Commercial Visitors (to Overseas Destinations). (Dept. of Overseas Trade, London).

These useful aids to travellers have already been noticed by us. Since then, several other destinations have been the subject of further pamphlets. Amongst those likely to interest our readers are the Hawaiian Islands ; Cuba, Dominica and Hayti ; British West Indies ; Netherlands East Indies ; and Czechoslovakia. Each pamphlet gives the needed particulars as to routes, hotels, currency and weights, etc., and such items of information as the traveller most stands in need of.

Brevities.

British Beet Crop.—F. O. Licht's estimate of the total sugar production of Great Britain for the current season is about 30,000 tons raw sugar or a reduction of 38·1 per cent. as compared with 1930.

South African Crop Estimates.—According to the Standard Bank Review the estimate of the current season's sugar output in South Africa has been lowered, owing to unfavourable climatic conditions and frost in certain districts, to 350,000 short tons. The exportable surplus will be about 184,000 tons of raws.

Java Crop Estimates.—Gijselman & Steup of Soerabaia estimated at 25th August last the production of the Java 1930-31 crop now being milled at 2,770,000 metric tons telquel, of which 2,520,000 tons come from factories members of the V.I.S.P. The latest estimate from Dr. Prinsen Geerligs puts the crop at 2,847,500 metric tons telquel.

New Worthington Pump.—The Worthington Pump & Machinery Corp., Harrison, N.J., have recently placed on the market a new Monobloc (Type D) Centrifugal Pump unit, destined to meet the need for a smooth running and reliable electric centrifugal pump of good efficiency, low initial cost, and low maintenance expense—the design and construction of which is such as to insure good service with but little care and attention. A pamphlet giving the specification and the wide range of ratings supplied can be obtained on application to the makers.

American Refining.—Imports of refined sugar from Cuba into the U.S.A. have been 166,720, 228,563 and 223,000 tons during 1928, 1929 and 1930.[1] At present under the Hawley-Smoot Bill, the duty on 96° raws from Cuba is 2·00 cents lb., and for 100° (refined) also from Cuba, 2·12 cents; but under the former Fordney-McCumber Act the two rates for Cuba worked out at 1·7648 and 1·918 cents. Hence the Fordney-McCumber was the more favourable Act, giving a differential between raw and refined of 15·32 cents. per 100 lbs. against one of 12 cents for the present system. But as 107 lbs. of 96° raw sugar are required to produce 100 lbs. of refined, the duty on the quantity of raws needed to produce 100 lbs. of refined is $2.14, as against a customs charge of $2.12 on the importation of 100 lbs. in refined form. On the ground that the existing tariff law handicaps rather than assists, a revision is sought by the United States refiners.

The Faraday Centenary.—In August, 1831, Faraday made the discovery of electro-magnetic induction, and during the recent period September 21st to October 3rd, the scientific world paid tribute to his genius. One of the principal features of these centenary celebrations in London was a comprehensive scientific and electrical exhibition at the Royal Albert Hall, opened on September 23rd by the President of the British Association, the Rt. Hon. J. C. Smuts, F.R.S. In the centre of the hall under an immense canopy was an impressive memorial dais, standing high upon which was a finely modelled statue of the "Prince of Experimenters," and around the statue were assembled many priceless relics. The very comprehensive series of exhibits related in general to the early forms of inventions arising out of Faraday's work, and more particularly to their many important modern developments in the fields of chemistry, electro-chemistry and electricity. A reproduction of Faraday's laboratory at the Royal Institution was another feature attracting attention.

Obituary Note.—It is with much regret that we announce the death at the age of 78 of Mr. Georges Dureau, the former editor and proprietor of the *Journal des Fabricants de Sucre*. He succeeded his father, Mr. B. Dureau, the founder of the Journal in 1878, giving all his time to it until in 1918 it was compelled temporarily to cease publication. It was then purchased by the present proprietor, Mr. H. S. Alexander, though Mr. Dureau continued to contribute to it for several years after. Mr. Dureau played a prominent part in the history of the beet sugar industry of France. He was foremost, for example, in the campaign against the system at one time in vogue of taxation on the basis of the finished sugar, instead of the raw product, being ultimately successful with the result that the sugar content of the roots, the extraction, and the general factory efficiency immediately began to increase. Mr. Dureau devoted himself with great energy to his paper, and gained the affection and respect of all those who came into contact with him.

1 G. E. Mayo in *Facts about Sugar*, 1931, 26, 331-334.

Review of Current Technical Literature.[1]

Oliver-Campbell Filter. **Robert C. Campbell.** *Report of Committee on Factory Practice, Hawaiian Sugar Planters' Association.*

A number of laboratory tests made with the Oliver filter by the writer in different Cuban mills had shown that No. 00 perforated brass, as used for centrifugal linings, forms a very desirable filtering medium for muds containing a certain amount of fine cane particles, viz., *bagacillo*, or "cush-cush." Working thus, the filtrate is cloudy until a thin layer of cake has been caught on the screen, after which the cake itself acts as the true filtering medium. A special filter has been designed to separate the cloudy from the clear filtrates, which gave rise to the Campbell filter, now known as the Oliver-Campbell filter, made by the Oliver-United Filters, Inc., New York and London. It is made in four sizes, having areas of 75, 150, 225 and 300 sq.ft. but as there are so many factors affecting the filtrability of the muds it is impossible to give the filters a fixed rating. In Cuba it is not unusual to find factories reporting only 1·25 per cent. press-cake on cane, but in Hawaii it ranges between 1·98 and 4·1 per cent. A more valuable figure for comparing filter-press capacities would be the percentage of insoluble solids in press-cake on cane, which usually runs from 0·4 to 0·9 per cent. It is next most important to know the per cent. suspended insoluble matter, which shows the volume of juice to be drawn through to deposit 1 lb. of insolubles.

Other two factors are the percentage of fine cane particles and of field dirt in the insolubles, the first being a good filtering material and the latter usually a bad one. Most muds require a ratio of about 30 : 70 of these two constituents, but a few muds may filter well when it is 15 : 85. Fortunately the ratio may be improved by the addition of fine bagasse, as obtained by sifting the bagasse going from the mills to the boilers. As the diameter of the perforations is 0·02 in., the bagasse can be re-screened to remove all particles not large enough to cover a perforation, though the uniform mixture of fine bagasse through the balance of the mud serves to make the cake more porous, increasing the filter capacity and improving the washing results. Some figures can be given for the operating costs for a factory of 50 t.c.h., equipped with 2 × 300 sq. ft. Oliver-Campbell filters, it being assumed that the length of the crop is 270 days, the total cane ground 260,000 tons, and the total sugar produced 30,000 tons. Labour is for one operator at $1.75 per 12-hour shift, equal to 2 × $1.75 × 270 ÷ 30,000 = 3·15 cents per ton of sugar. The brass medium is allowed for at the rate of 350 sq. ft. per filter at $1.20 per sq. ft. over three crops, or $264 per crop, or 0·88 cent. per ton of sugar. There is a charge for power consumption. Using about 150 per cent. of wash-water on the cake, the pol. can be reduced to between 1·0 and 1·4 per cent., but about 72·5 per cent. of this water remains in the discharged cakes. When sugar is selling at 3·15 cents a lb. in New York, 1 lb. saved at the filter station is worth about 2·4 cents. Using the 1920 Hawaiian averages of 2·5 per cent. press-cake on cane at 2·3 pol., and assuming that the Oliver-Campbell filter-cake will average 1·2 pol., we find that the annual savings in sugar will be worth 260,000 × 2·5 × (2·3 — 1·2) × 2000 × 2·4 = $3432.

Preventing the Deterioration of Raw Sugars (and Increasing their Polarization) by the Torulae Inoculation Process. **Anon.** *Communicated to this Journal.*

Deterioration of raw sugar has been shown to be due to the development of mould fungi; but by inoculating the surrounding film of molasses with torulae the other group of micro-organisms can be effectually suppressed, and deterioration

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 395. NOVEMBER, 1931. Vol. XXXIII.

Notes and Comments.

Great Britain returns to Sane Government.

Even in a journal devoted to the sugar industry all over the world one has no hesitation in counting the result of the Parliamentary Elections in Great Britain as the most important piece of news of recent months. For so much hung on these appeals to the electorate. Not merely how the country was to be governed during the next few years but whether it was to maintain its position as a world economic force or else sink to the status of a second-rate Power. The National Government with the former Labour Prime Minister at the head of a combination of parties appealed to the electorate for a free mandate to take any steps found advisable to restore the economic balance of trade and reduce the excessive expenditure (especially on unemployment pay) that was gradually driving the country bankrupt. The official Labour Party on the other hand, under the driving force of the Trade Unions caucus, were bent on spending yet more on the amelioration of the lot of the organized workers in the belief that the money was there in the hands of the supposed rich. Labour conveniently ignored the peril to which all the other parties were alive—the effect on foreign opinion of any further spendthrift policy and thereby the grave danger of a further flight from the £.

Although wireless broadcasting had been tried tentatively at previous elections, this was the first time that it was brought into full use for letting the electorate know the views of the different parties; and about a dozen political speeches of varying shades of leading opinion were heard by listeners-in night after night, safe from the vocal disturbances of a political meeting. This new scientific aid undoubtedly played an influential part in deciding the fates, as thereby a vastly increased number of the people were able to listen to the pros and cons of the political appeals. Probably the greatest factor in deciding men's (or rather women's) minds was the fear that the £ would so fall in value that food taxes of a calibre such as only the most extreme protectionist would envisage would have a mild effect on food prices compared to what a flight from the £ sterling would bring along.

So it came to pass that the gravest elections of the century in this country have resulted in the most unprecedented rout of the offending party that we have experienced in modern times. Almost everywhere the National Govern-

ment representatives were returned with overwhelming majorities. Labour which was 265 strong at the Dissolution has saved only 52 seats out of 615 in the House of Commons, and more than half of these are mining constituencies where previous majorities were overwhelming. Every member of the late Labour Cabinet save one (not counting the Ministers who came over to the National Party and were almost all successful) was defeated, in some cases by novices to Parliamentary honours. As a rule Conservatives and Liberals arranged locally not to split the constitutional vote lest the Socialist be let in on a minority vote. As a consequence the National Government has obtained the wholly unexpected majority of 499, of which no less than 471 rank as Conservatives and follow Mr. Baldwin.

The country has spoken so decisively that the rest of the world will be under no doubts or illusions as to the public attitude to Britain's financial crisis. The way is now clear to inaugurate a policy of reform and retrenchment—reform in all probability of the Government's ideas of helping trade and industry, and retrenchment in an expenditure which, whatever may be said for it in prosperous times, the country certainly cannot afford nowadays. Retrenchment in taxation is unfortunately not an immediate possibility, but the tax payer will certainly insist on it in the not distant future.

The New Policy.

The new Parliament is meeting immediately, but at the time of writing we still await the King's Speech which at the opening of a new Parliament outlines the intended Government programme. Free trade and Protectionist views as expressed by extreme partisans have been busy trying to interpret the verdict of the country as respectively (1) no mandate for a departure from free trade unless further enquiry finds it absolutely necessary, and (2) a mandate for full protection. It will probably be found that the Government policy lies between the two. There is no doubt that free trade as practised of recent years has been tried in the balance and found wanting. A measure of tariff reform, if only to remedy the adverse balance of imports over exports, is a most urgent necessity. But it will have to be devised scientifically and be put, so far as possible, under the control of an impartial body representing both manufacturing and consuming interests. Yet the success of the few industries already protected by the so-called safeguarding duties has been too obvious not to be extended. The home manufacturer, not excluding the engineer, ought now to be assured of his home market, so that he can the more easily pay his overhead expenses and be able to quote more favourably for export business. The stimulation of food production at home is a not less necessary task, but is bristling with difficulties which a National Government is far better placed to solve than a Party Government can ever be. At the back of it all lies the necessity to reduce the tremendous amount of unemployment, the cost of which hangs like a millstone on the neck of the country.

Its Effect on World Conditions.

The international effect of this victory at the polls in the United Kingdom offers considerable possibilities. At bedrock it will reassure those abroad who feared that our country was going the way of Russia. Any catastrophe in this country would have severe repercussions in every other land whose financial stability was linked up with a like stability in ours. Consequently, there will not be lacking a feeling of confidence which will be all to the good in the financial world at large. True, we are not yet out of the wood, but the

preliminary clearing at any rate has been made. The new Government must not only solve home problems, but must use its great opportunity to smooth over international difficulties. The world for lack of confidence has got into an *impasse* where, while production is excessively cheap, consumption cannot get going to absorb it. If the vicious circle that thereby results can be broken by the restoration of confidence the world over, international trade may succeed in casting off its shackles and revive in earnest.

The New Outlook for Empire Sugar.

Sugar industrialists will naturally await with interest the effect of the new régime on the fortunes of the British sugar industry. It will be noted that the Conservatives have a majority in the new Parliament over all possible opponents. They have indeed a giant's strength, which however, it is to be hoped, they will use with forebearance. But they were the party who inaugurated Imperial Preference and instituted the differential sugar duties. Both the Prime Minister and Mr. J. H. Thomas, the most outstanding figures in the policy of putting Country before Labour party, are known to be sympathetic to the idea of Imperial reciprocity, so it may be counted as certain that pourparlers will be started early with the Dominions and Colonies to bring it about. The sugar duty already exists, and is a convenient form of indirect taxation. Hence the odds on its being altered in the next Budget, to ensure increased preference for Empire sugar, seem large.

At the same time we have little fear that the powers that be will encourage any rapid expansion of home and Empire grown sugar to the detriment of the position which the Chadbourne restriction scheme seeks to establish. Our British colonial sugar industry has suffered too severely in the recent past from low prices to wish to prolong the process by injudicious expansion. Over and above a more generous preference from the Mother country they want an economic price for their product that will allow them to finance arrears of maintenance, and to modernize their establishments so that these can compete fairly with other producing centres. Once the money is found, the process of replacing innumerable small and not very up-to-date factories by a fewer number of modern centrals will call for attention, for the preference given must be justified by results. Mere expansion without modernization will not suffice, and the expansion itself must be calculated.

As for the beet sugar industry in England, we have always thought there was room for it, especially since the Great War demonstrated the inconveniences of our utter dependence on overseas supplies of sugar. But we have little sympathy with the recent view that the bulk of our sugar should now be produced in this country. So long as cane sugar is intrinsically cheaper to produce than beet, the bulk of our supplies should continue to come from our dependencies overseas. It is their natural staple crop in many cases ; ours is only a valuable item in crop rotation which has served a useful rôle in giving the farmer a paying crop when all others were depressed. The remedy for the British farmer now should surely be an all round encouragement of the staple food products of the soil, not the further expansion under an admittedly heavy subsidy of one particular food crop. Let the beet sugar factories at home continue if possible ; they will serve to keep a useful industry in existence. But their further multiplication hardly seems called for till agriculture in the United Kingdom has had a chance to restore its fortunes in other lines of food production, and to discover which of these will pay it as well or even better than an expansion of the sugar beet cultivation.

Imperial Sympathies in the New Cabinet.

Since writing the above, the news has been published of the personnel of Mr. MACDONALD'S new Cabinet. That most important post of Chancellor of the Exchequer has been given to Mr. NEVILLE CHAMBERLAIN, which means that a tariff reformer succeeds an insistent free trader, and that future taxation will differentiate in a more marked manner our overseas ties. Mr. THOMAS remains at the post he occupied in the Labour Administration, the Dominions Office, where he may be expected to encourage improved trade relations with the other parts of the Empire. The Colonies are to be under Sir PHILIP CUNLIFFE-LISTER, who previously had been at the Board of Trade and may be trusted to consider sympathetically the representations of our colonial sugar industry. Finally, to the Board of Trade goes Mr. RUNCIMAN, a former free trader, who has seen fit to modify his views and has suggested the prohibition of unnecessary imports till the trade balance is put right. These four are the men who will be most immediately concerned with restoring and confirming that trade balance, and the country will trust them to do their best without party bias.

The World Outlook.

During the past month sugar prices have tended to droop due to inactivity in the "actual" markets, but sales of Cubans in New York have been maintained around 1·40 cents. Indeed the New York market has been more favourable for sellers than the London one, where various adverse influences have temporarily depressed prices. Cuba is evidently finding that it pays better under Chadbourne restrictions to get 1·40 cents for what she is allowed to sell than to dispose of her whole crop in an unrestricted market at a price which would probably be under 1 cent. in the prevailing conditions. On the other hand, Java is faced with an unaccustomed lack of ready markets for her crop just finished. The latter is reported to be lying unsold in her warehouses, largely because her Eastern markets are unsettled from civil war, famine and flood. China has experienced unparalleled floods during the last few months; in the Yangtze valley alone the flooded area is about equal to that of England and Wales; and drowning, disease and starvation may bring along the death of many millions. As for India, she is not only boycotting Lancashire cotton but now also dispensing with Java sugar.

To turn to Europe, LICHT'S latest figures of the beet crop show a slight increase as compared with the last estimate, thanks to favourable weather during October. As compared with September 30th, the estimate is raised from 6,171,000 metric tons raw sugar to 6,220,000 tons for Europe without Russia. The President of the Russian Sugar Trust has published conflicting figures, one day giving the Russian out-turn as 2,150,000 tons and a few days later as 2,613,000 tons. LICHT inclines to the smaller figure. But it has just been announced in the press that the four technical directors of the Sugar Trust have been dismissed from office for publishing intentionally false reports about the wheat and sugar crops. Apparently they have understated the tale of wheat to allow the peasants to keep some for their own use. But it is not so obvious that they would have a like incentive to understate the beet crop unless they wanted the roots for feeding cattle. More likely it may prove they have over-stated the beet acreage, so that the total acreage of beet and wheat may pass muster with the records of acreage under cultivation. Be this so or not, we can only await the full disclosure that must come in due course.

Notes and Comments.

As is known, sugar is only one of an unprecedented number of world staple crops that are suffering from over-production and uneconomic prices. The greatest of all is wheat, and the farmers in the great wheat tracts of the New World have been in the same uneconomic plight that sugar planters have experienced. Now it is reported that wheat (also cotton and wool) have lately taken a turn for the better, which it is hoped will be maintained. Here, too, Russia is proving a factor, as her crop is supposed to be below expectations and her supplies over-exported. The influence of wheat on the international markets is undoubtedly very great, and if it turns out that that commodity has seen its worst days, this will prove a powerful factor in stimulating the recovery of other staple crops. What is most wanted is of course stability in international finance, which not only means stability of exchange under a better standard than the present restricted Gold one, but also the settlement of war debts. The new Government in London will be in a better position than its predecessors to work for that consummation, and the whole world will hope that it will give a strong lead.

Peru joins the Brussels Sugar Agreement.

The International Sugar Council announces as a result of recent negotiations with the Sociedad Nacional Agraria of Lima (an Association empowered by Presidential Decree to represent the Peruvian sugar industry for the purpose of entering into international agreements and of fixing production and export quotas for producers in Peru) the adherence of Peru to the International Sugar Agreement of 9th May, 1931. The export quotas for Peru have been fixed at 360,000 long tons for the current year and 373,750 long tons for each of the four succeeding years of the Agreement. While allowance had to be made in fixing these quotas for the large plantings of cane already made for 1931 and 1932 by Peru, that country has undertaken, in accordance with the principles of the Agreement, to adjust future plantings in such a way that at the end of the five-year period she will have no surplus stock on hand. Peru will accordingly be admitted as a full member of the International Sugar Council, on which she will have the right to five votes.

Triennial Meeting of Sugar Cane Technologists, 1932.—As at present arranged, the International Society of Sugar Cane Technologists will hold its fourth Triennial Conference at San Juan, Porto Rico, from March 1st to 16th, 1932.

More Sugar Factories for India.—Mr. W. J. Alcock, the Consulting Engineer, Calcutta, has been requested by Messrs. Birla Brothers, of Calcutta and Bombay, to design and erect for them two 400-ton cane crushing factories and also one 250-ton one.

Factory Replacements in British Guiana.—Messrs. George Fletcher & Co., Ltd., of Derby, have just booked an order for the re-organization of the milling plant at Rose Hall factory, Berbice, British Guiana. An old 5-roller mill is being discarded and a new 3-roller mill and gearing is being added to an existing 6-roller plant; in front of this is to be placed a new 5-roller mill, engine and gearing. The existing 6-roller mill has Fletcher patent angled headstocks, but the two new mills are to have standard headstocks, and the hydraulics are being offset so as to compensate as far as possible for the unequal pressures between the rollers. In addition, the Krajewski crusher headstocks are being designed so that a Maxwell shredder can be added at a later date. It should be noted that this new plant is to replace existing machinery which is worn out, and it is to be hoped that this order will prove the forerunner of others from sugar factories in the British Empire which stand in need of re-organization and are only waiting for signs of economic recovery, as well as for increased Empire preferential trade arrangements.

The Statistical Position in the Sugar Industry.

By H. C. PRINSEN GEERLIGS, Ph.D.

. Now that estimates of the new sugar crop (September 1931-August 1932) are at hand, it has become possible to hazard a view of the position of our article in the immediate future. We have combined below in one table the results of the 1930-31 crop and the prospects of the 1931-32 one in thousands of tons raw value. The figures for Europe, Java and Africa are expressed in metric tons, and the others in tons of 20 cwts.

All figures refer exclusively to crystallized sugar, in the case of whites calculated back to the equivalent of raw on the basis of 9 parts of whites equal to 10 parts of raws. The desiccated cane and palm juice of British India, Java, Philippines, Japan, Central and South America is not included in the figures. Those figures, respectively 350 and 400, of British India refer therefore to the equivalent in raws of the white crystallized sugar produced in that country.

The figures for Europe, except those for Russia,[1] are derived from Mr. LICHT's statistics ; all the others have been computed by us from a great many reliable sources.

It will be seen from the Table that the world's crop of 1931-32 will be smaller than its predecessor by 2,200,000 tons or 8·5 per cent., and that Europe is the greatest contributor to that decrease, by 1,647,000 tons or 15·5 per cent. ; also, that its share of decrease would be still more considerable, viz. by 2,417,000 tons or 30 per cent., if Russia had not largely extended its production by 720,000 tons or 40 per cent., or at least claims to be able to do so.

This year well-nigh every European country except Russia restricted its sowings, not only those who had pledged their word in the Brussels International Agreement of 9th May, 1931, but also almost all the others. Further, the weather has not been so favourable as in 1930, so that for that reason also smaller crops have to be expected.

It is evident that the figures given for 1931-32 are not final and remain liable to change, but a smaller crop from European countries outside of Russia by some 2,400,000 tons may be expected. And even if Russia should produce 2½ million tons of sand sugar, or 2,750,000 tons raw equivalent, that excess of 720,000 tons over her last year's crop would not have the same influence as if any other European crop had extended its production by that amount.

In Russia sugar consumption has been curtailed by Government measures to a very low level, and if, indeed, the sugar supply should become much larger, a notable increase of consumption within the frontiers of the Soviet Republic may be anticipated. The total increase of Russian sugar offered in the world's market need not exceed 100,000 or 150,000 tons, even allowing for the increase of production forecasted by the Sojus Sacchar authorities.

EUROPE will, therefore, have about 2,250,000 tons less to offer or more to demand than in 1930-31.

JAVA has, in accordance with its adherence to the Brussels scheme, restricted her sowings by about 17 per cent. and will produce in 1932 about 2,700,000 tons raw value, against 3,050,000 in 1931.

In the UNITED STATES beet sowings have been reduced, while the cane sugar crop is not so good as in the previous year.

[1] LICHT gives, under all reserve, the figure of 2,150,000 tons. We have preferred to use the official one of 2,740,000 tons without criticism or comment.

The Statistical Position in the Sugar Industry.

COMPARISON OF THE PRODUCTION OF SUGAR IN 1930-31 AND THE PROSPECTS FOR 1931-32 IN THOUSANDS OF TONS RAW VALUE EQUIVALENT.

			In 1931-32	
EUROPE.	1930-31.	1931-32.	More.	Less.
Germany	2547	1650	—	897
Czecho-slovakia	1126	830	—	296
Austria	151	165	14	—
Hungary	234	145	—	89
Poland	785	560	—	225
Netherlands	293	180	—	113
Belgium	283	240	—	43
France	1205	910	—	295
Italy	415	360	—	55
Switzerland	6	6	—	—
Spain	350	345	—	5
Denmark	168	125	—	43
Sweden	186	147	—	39
Bulgaria	58	28	—	30
Yugo-Slavia	103	80	—	23
Rumania	170	65	—	105
United Kingdom	473	315	—	158
Ireland	26	8	—	18
Russia	1980	2750	770	—
Other countries	58	61	3	—
Total	10617	8970	787	2434
ASIA.				
British India	350	400	50	—
Java	3050	2700	—	350
China	150	100	—	50
Japan and Formosa	871	1000	129	—
Philippines	784	750	—	34
Other Countries	50	50	—	—
Total	5255	5000	179	434
AMERICA.				
Canada	45	50	5	—
United States (beet)	1195	1100	—	95
,, ,, (cane)	164	145	—	19
Mexico	235	180	—	55
Hawaii	855	860	5	—
Cuba	3118	3000	—	118
Porto Rico	696	750	54	—
San Domingo and Haiti	379	400	21	—
British Antilles	313	240	—	73
French Antilles	62	65	3	—
Central America	83	70	—	13
Demerara	115	115	—	—
Surinam	12	10	—	2
Venezuela	40	40	—	—
Peru	422	415	—	7
Argentine	420	400	—	20
Brazil	525	570	45	—
Other countries	40	50	10	—
Total	8719	8460	143	402

AFRICA.	1930-31.	1931-32.	In 1931-32 More.	Less.
Egypt	90	90	—	—
Mauritius	207	178	—	29
Réunion	50	30	—	20
Natal	330	310	—	20
Mozambique	90	90	—	—
Other countries	50	50	—	—
Total	817	748	—	69
AUSTRALIA.				
Commonwealth	525	545	20	—
Fiji	80	90	10	—
Total	605	635	30	—
EUROPE	10,617	8970	—	1647
ASIA	5255	5000	—	255
AMERICA	8719	8460	—	259
AFRICA	817	748	—	69
AUSTRALIA	605	635	30	—
GRAND TOTAL	26,013	23,813	30	2230
BALANCE		2200	2200	

MEXICO has reduced its plantings according to Government regulations.

CUBA has already in 1931 curtailed her crop considerably and it is not at all certain how much that island will be allowed to produce in 1932. We have assumed a figure of 3 million tons, being the maximum amount equivalent to the cane in the fields.

MAURITIUS and RÉUNION have suffered from a hurricane and SOUTH AFRICA from drought; but, on the whole, the differences in the other countries are immaterial.

RUSSIA then is the only country, which will appreciably increase its output; all the others have either kept to their level or have decreased.

In 1930-31 production exceeded consumption by 1,500,000 tons, but for 1931-32 it is supposed that production will remain 1,300,000 tons below consumption, thus causing the stocks to decrease by that amount.

LICHT gives the following account of stocks on 31st August, 1931 :—

	Tons.
Europe (7 countries)	2,084,000
United States	540,000
Cuba	2,560,000
Java	2,725,000
Total	7,909,000

If, then, the above forecast is realized, we shall see a reduction of the world's sugar stocks during 1931-32 from 7,873,000 tons to 6,573,000, or by 16·5 per cent. This figure of 6,573,000 tons naturally does not mean a surplus quantity to be worked off by extra consumption, but includes the sugar necessary for consumption and exportation until the advent of the new crops. For Europe this period is only some six weeks, but is much longer in the case of Cuba and Java, being respectively some four and eight months.

The Chadbourne Plan.

As Viewed by British West Indian Interests.

Presiding over the annual meeting of the St. Madeleine Sugar Company Ltd., of Trinidad, the Chairman, Mr. G. Moody Stuart, spoke hopefully of the prospects for the sugar industry from the working of the Chadbourne restriction scheme. Cuba's policy of over-production since the war, he said, had now been changed to a policy of fitting the Cuban production to the needs of the market. As a result of the general policy of restriction of output, world production is in process of being brought below consumption. "It is difficult to arrive at a close forecast of production and consumption during the 1931-32 season, but on present indications it would appear that production may fall below consumption to the extent of about 1,800,000 tons. The world production, excluding Russia, is estimated at 23,800,000 tons, and the consumption at approximately 25,600,000 tons.

"Prices have not yet responded to the changed position. One must remember it is a five-year plan, and one could not look for any great improvement before even the first year had been completed, but there is no doubt that if we had not been under this financial crisis we should even now have seen some advance. However, the assured reduction in supplies gives the assurance of better times some day. Meantime we must have patience and allow time for excess stocks to work down.

"Even when higher prices are established we will still require our present preference and the additional help, too, which Mr. Baldwin indicated some time ago he was prepared to approve of. Germany gives a protection at par of exchange of £15. 18s. 3d. a ton ; France £13. 18s. 9d. ; the United States £12. 5s. ; and we get £3. 15s.! It is a marvel that we have been able to carry on even in the way we have been doing. We ought to be given some further help until the day comes when all protection is swept away and we are all on an equal footing.

"The Chadbourne Plan has been drawn up with foresight to remove any temptation to extend planting in countries outside the agreement. The basis price aimed at is 2 cents f.o.b., a strictly moderate figure, and it is provided that when the market goes above that there will be an additional release of sugar from the segregated stocks, this provision being in order to prevent the temptation to plant more.

"The rubber industry in its restriction schemes went on the opposite tack, starting with a basis price so high that it attracted a rush of new planting, and when the market had come up to that price it fixed a new basis 40 per cent. higher, and so gave more and more temptation to extend planting further, and thus brought ruin on the industry.

"The summary which I have given of what Mr. Chadbourne has accomplished gives no idea of the stupendous task it was to carry it all through. . . . . Success could only have been won by a man of Mr. Chadbourne's strong personality, his indomitable courage, indomitable determination, and indomitable will-power. I feel we owe him a deep debt of gratitude. He has made this year a year that will always be memorable in the history of the sugar industry. I suppose we ought to bear in mind Burns' warning that 'The best laid schemes of mice and men gang aft agley,' but I do not believe Chadbourne's will do so."

Oxford Process.—The concern known as Sugar Beet & Crop Driers, Ltd., who conducted the Eynsham factory, near Oxford, where the experimental work on the production of sugar from dehydrated beet slices according to the Owen process was carried out, is now in course of being wound up. The factory plant has been sold by auction.

The Beet Sugar Industry in the United Kingdom.

Official Results of the 1930-31 Campaign.

The following, taken from the official records issued by the Board of Agriculture, is a summary of the revised results for Great Britain of the 1930-31 beet sugar manufacturing season, as compared with the previous year. The record acreage gave a record production both in the field and the factory. The acreage under sugar beet and the tonnage of beets delivered to the factories showed an increase of just over 50 per cent. compared with 1929-30, but owing to the reduction of 1 per cent. in the average sugar content of beets the increase in the total production of sugar was somewhat less (45 per cent.).

	1930-31.		1929-30.
Acreage under sugar beet	348,920	..	230,531
Average yield per acre (tons)	8·8	..	8·7
Number of beet growers	40,415	..	32,204
Number of factories....................	18	..	19
Average number of days worked	111	..	91
Number of workers employed in factories during the campaign	9,900	..	8,889
Tonnage of beets delivered to factories ..	3,060,498	..	2,003,586
Average sugar content of beets (per cent.)	16·7	..	17·7
Average price paid per ton of beet	49s. 10d.	..	52s. 11d.
Estimated total sum, including cost of transport, paid by the factories to the growers	£7,626,000	..	£5,301,000
Total production of sugar (cwt.)	8,485,965	..	5,841,489
Average extraction of sugar expressed as a percentage of beets delivered to factories	13·9	..	14·6
Average extraction of sugar expressed as a percentage of total sucrose in beets	83	..	83
Average farm output of sucrose per acre of beet grown (lb.)	3,289	..	3,440
Average factory output of commercial sugar per acre of beet grown (lb.)	2,724	..	2,837
Production of by-products :—			
Molasses (cwt.)	*2,118,000	..	1,480,051
Pulp: Dry (tons)....................	199,964	..	138,145
Pulp: Wet (tons)....................	63,695	..	21,212
Subsidy paid :—			
Sugar	£5,512,875	..	£3,794,288
Molasses	*£629,000	..	£439,488
Total Subsidy.................	*£6,141,875	..	£4,233,776

* Subject to slight adjustment.

The 1931-32 *Campaign.*—According to the preliminary returns for the 4th June, 1931, the acreage under sugar beet this year was estimated at 234,400 acres, a figure which, although substantially less than last year's record acreage, is still higher than that for any year other than 1930. The decrease compared with last year is approximately 33 per cent. and is largely attributable to the reduction in the rate of subsidy payable under the British Sugar (Subsidy) Act of 1925 upon the commencement of the third and last subsidy period on 1st October. 1931. It is of interest to note that the reduction in subsidy at the beginning of the second subsidy period in 1928 was accompanied by a fall in the acreage under sugar beet to 178,047 acres compared with 232,918 acres in 1927—a reduction of about 24 per cent.

Recent Work in Cane Agriculture.

CANE DISEASE CONTROL THROUGH ADJUSTMENT OF PLANTATION PRACTICES. **J. P. Martin.** Annual Meeting of Hawaiian Sugar Technologists, 1931.

For fear of misunderstanding, the author defines the term " disease " as follows : " A disease is manifested by a deviation from the normal function or structure in the plant, and is usually recognized by structural changes, depressed growth, development of abnormalities, the presence of definite spots, stripes, blotches, markings, or the interruption of physiological activities of the plant. A disease may affect a portion or the entire plant and may cause a malformation or premature death of that portion or of the entire plant." This is a very wide definition, and he classifies such diseases as non-parasitic, parasitic and virus. There is no distinction here between pests and diseases in the usual sense, and the author appears to include all the ills that the cane plant is heir to. Faults in soils, deficiencies and the presence of toxic substances, deficiencies of applied nutrients, and the less essential elements such as manganese, boron, copper, titanium, zinc, arsenic, and excess of iron and aluminium, and so on. The effect of wind, drought, sun, elevation, low temperature, lightning, fire, grease from implements, mechanical injuries, and inherited characters. These are all included in the first list the author gives, but in the second, which deals expressly with plantation practice, he restricts his remarks mainly to the fungus diseases that have been met with in Hawaii.

Disease resistance is given a prominent place ; and it is mentioned that this is easy to determine with regard to cane varieties, but that is not all : the commercial merits must be studied, not only by the yields of plant canes but by that of the ratoons, and the latter study extends over a long time, " and many disappointments are to be experienced."

The body of the paper consists of two comprehensive lists containing the information thus far gathered (by himself and his colleagues). (1) The diseases and their causal agents. This is divided into those affecting leaves : spots or blotches, stripes or streaks, wilting or rolling, malformation of the top, irregular bands, chlorosis, burns. Leaf sheaths : scald, iliau (binding), red rot, Phyllosticta, mites. Stalks : external symptoms, malformation, internal symptoms, bundle or general discoloration. Roots : fungus rots, nematodes, other animals, malformations, non-parasitic blemishes (reddened roots exposed to light and air). Tassels : tassel top and bunch top. The whole plant : parasitic root rots, nematodes affecting roots, nutritional disturbances.

(2) Diseases, their causal agents, and the plantation measures of control. The diseases referred to are eye spot, brown stripe, mosaic, leaf scald, chlorotic streak, ratoon chlorosis, Pahala blight, banded chlorosis, coral chlorosis, red stripe, pokka boeng, ring spot, iliau, sooty mould, red rot, pineapple disease, stem galls, Pythium root rot, nutritional disturbances. The following may be taken as examples of this section. Leaf scald, causal agent *Bacterium albolineans*, affects primarily stalks and leaves : treatment resistant varieties, healthy cuttings, roguing, sterilization of cane knives, subjecting cane cuttings to hot water treatment (20 minutes at 52°C.) if there is any doubt. Pahala blight, causal agent deficiency of manganese or iron : treatment applying manganese, application of sulphur (1000 to 2000 lbs. per acre). Red stripe, causal agent *Phytomonas rubrilineans*, primarily a leaf disease : treatment resistant varieties, methods favouring cane growth, avoiding having young cane during wet weather by early planting and

harvesting. Eye spot, causal agent *Helminthosporium sacchari*, primarily a leaf disease: treatment resistant varieties, avoiding heavy nitrogenous manuring towards end of growing season, planting and harvesting early, avoiding young canes entering the eye spot season, two-year cropping with harvesting during March or April and applying nitrogen in early part of each growing season. Coral chlorosis (limestone), causal agent excess of soluble calcium: treatment spraying chlorotic plants with 5 per cent. solution of iron sulphate (if necessary repeatedly), application of ammonium sulphate rather than sodium nitrate.

CANE CULTIVATION IN THE UNIRRIGATED DISTRICTS OF HAWAII.[1] **G. Rose.** Meeting of the Association of Hawaiian Technologists. 1931.

The actual field practice in the island of Hawaii will be more interesting to the planters in most countries, because of the absence of irrigation. The details here gathered together were obtained by a questionnaire sent to representative plantations, but the author notes that even although the practices are founded on years of careful observation, they often differ on neighbouring estates, "without much thought or application of economy."

The clearing of land for planting will usually refer to replanting after 10 years growth of ratoons, when a thorough clearing of the land will reduce the cost of future work. Tractors with ropes and chains have been found effective for removing old stumps or guava and Lantana scrub, but mules are employed where tractors cannot be used. Some estates use FOWLER'S steam tackle in the off-season for larger trees or blasting. Practically no swamps have to be dealt with in Hawaii, because of little irrigation. *Ploughing for plant canes.*—The need is for a quick full stand and a healthy growth thereafter for 8 to 10 years. The methods and tools are quite different on the various plantations; but usually two ploughings, with disc or mould-board ploughs, drawn by a Fowler's outfit or by mules, are given, in some cases preceded by a stool buster. A few plantations allow a fallow for a few months, during which mud press is spread over hills and bare spots. The first ploughing is not deep, and a rough harrowing is given, preferably immediately before the second ploughing, to reduce the thick crop of weeds. The second ploughing in most cases is from 16 to 18 inches. A Best "60" tractor hauling two Oliver disc ploughs will usually cover 10 acres in a day on fairly uniform fields, and if well done will put the field in a fine condition for planting. The soil type has much to do with the number of harrowings: heavy, sticky or lumpy soil needing more than light, porous land. Usually two disc harrows drawn by a caterpillar tractor should do, with a long spiked harrow drawn by three or four mules for very uneven spots.

There is much discussion as to whether *furrowing* is needed, the general opinion being that it places the seed cane in the poorest part of the seed bed. The usefulness of the furrows is to keep the lines straight, and this is often frustrated by a shower which obliterates them. An experiment was made of 100 lines each with furrows made with an ordinary mould-board plough, and a smaller two mule mould-board plough, compared with 100 lines of flat planting. "The small mould-board plough did an excellent job. The sub-soil was not reached and after the seed was planted and covered it was difficult to tell the difference between it and the flat planting." It is usual to plant the makai (towards the sea) fields deeper than the mauka (towards the mountains) fields. The sub-soil is not reached so soon, and many of

[1] See also *I.S.J.*, 1929, 652-657.

the mauka fields become waterlogged, so that "by furrowing deep we should just be planting in a bath of water."

Width of furrow depends on the variety, subsequent cultivation, and the number of ratoons expected. Yellow Caledonia (makai fields) has a spreading stool in ratoons and five feet would be suitable; while D 1135 grows quite erect, closes in later and does not spread in the ratoons, and four feet furrows should be sufficient.

Planting is all done by hand because of the unevenness of the fields. All of the Yellow Caledonia is planted with top seed and most of the D 1135. It is customary to flume seed cane from the fields, and it is found advisable to allow it to lie in a pile for a few days, as this causes better and quicker germination. The seed is laid flat in the furrow, with the buds at the sides and pointing in direction of the wind, which is of special importance in windy places. When a new kind is being planted (such as POJ 36) the whole plant is cut up, except the lowest six or seven inches which is later cut and carried to the mill. *Cultivation.*—As a rule team implements are kept out of plant cane till the stand is well established, although one or two hoeings are usual before any team work. From then on the Planet Junior cultivator is used before hoeing. The number of rounds depends on the weather and time of planting, but about three rounds on the lower fields and four to five on the upper are sufficient till the field is laid by. Hilling is gradually dying out; and barring off is losing ground, but is used more on plantations which do not burn the trash after harvesting.

Fertilizing is a question of major importance, although the practice is not accurate enough, as to the exact measurement of the fields, and thus some fields are over-fed and some under-fed. It is obvious that the fertilizer should be placed as near to the roots as possible, especially with regard to the phosphates. But care has to be taken with large doses of rock phosphates, as the young roots are killed off by the acid developed. All is given by hand, the men walking between the rows and laying the manure along the canes: one man will spread from 12 to 16 bags in a day. At Hakalau they use the B-12 formula, which is 6 per cent. nitrogen, 6 per cent. phosphoric acid and 20 per cent. potash: last year they spread at Hakalau 11 bags of B-12 and seven bags of sodium nitrate, making a total of 275 lbs. of potash, 82·5 lbs. of phosphoric acid and 218 lbs. of nitrogen. Most apply a spring dressing of nitrogen, but an experiment shows that this is unprofitable. The results gave a higher yield of cane and sugar and a lower QR, without the spring dressing. Another debatable question is whether it is necessary to cover the fertilizer, although most plantations do this, with small ploughs, cultivators or hoes. After the plant crop is up and a good stand established, the fertilizer may be covered by using a small sub-soiler. This saves time and does not injure the crop.

Harvesting.—The problem of bringing a field to maturity is more difficult on unirrigated plantations, because there is no control of the water. The plantations in Hawaii have to take what they get, and there is usually too much water. Stripping the canes may be an aid in drying out a field: an experiment with it has given as much as half a ton of sugar per acre over the non-stripped plots: Brix, polarization and purity were increased and the quality ratio (QR) lowered: the plots were only stripped once. Burning the field before harvesting is desired, as it makes the work easier and there is less excuse to cut high, but it is often not possible to get a good burn because of the rains. Nearly all canes are flumed to the mill in Hawaii. The flumes are laid

seventy-five feet apart, and the cutting and laying of the canes is done by contract, each cutter tying his bundles to 60 lbs. weight under penalties. All flumed cane is weighed on the field. The fields are so uneven that loading cannot be done by mechanical means.

Preparation and cultivation for ratoons.—The field is *palipalied* as soon as possible after cutting, thus removing dead cane tops from the stools. Three weeks later the first hoeing and fertilization are given, the fertilizer being covered by a small plough. From this time onwards till the canes close in, Planet Junior cultivators and *hapai* (lifting) harrows do most of the cultivating work. A few of the plantations are beginning to subsoil their ratoons. It should be done at the right time, i.e., when the new roots have appeared but not yet entered the soil. For this the weather must be watched and dry spells avoided. Off-barring is still occasionally practised. When subsoiling is not done, the soil is loosened round the roots with a small plough. If the ratoons are old, some replanting will be necessary : seed cane may be used or if the stand is heavy even stools. The amount of fertilizer is about the same as in plant canes or a little less ; and is spread along the tops of the stools.

A Comparative Study of the Stem Epidermis of Certain Sugar Varieties. **Ernst Artschwager.** *Journal of Agricultural Research*, Vol. 41, No. 12, December 15th, 1930.

From a casual study of the anatomical structure of the epidermis of certain varieties of sugar cane, differences were noted which suggested that these might be of use in classification. In order to provide material for determining this, separate varieties and certain hybrids of four species of Saccharum were grown in a plot under uniform conditions, namely *S. officinarum*, *S. sinense*, *S. Barberi* and *S. spontaneum*. To avoid differences in structure, owing to differences in age (as have been noted in the epidermis of maize), it was endeavoured to select the material at a definite stage of growth. The epidermis was examined at the middle of the internode of joints which had reached maturity and were no longer enveloped by the leaf sheath, and on the average ten specimens were examined of each variety. The material was prepared for microscopic examination by cutting out small pieces, and macerating them in potassium chlorate and strong nitric acid ; on boiling this mixture thin pellicles of epidermis separated themselves off, and these were washed and mounted on slides, and then stained with chloro-iodide of zinc. If the maceration has been carried to the right stage, this will stain the cells of the epidermis bright blue, corky cells will turn golden yellow, while silica will remain unstained.

The cells of the epidermis of the sugar cane occur in long parallel rows and are of different shapes and sizes. There are (1) elongated cells forming the great bulk, which stain bright blue, but show numerous small unstained portions : these are pits in the cell wall bordering on the tissues inside, and the radial walls of the epidermis are also extensively pitted : the outer walls are heavily cutinized, are without pits and do not appear to stain. (2) Short cells of two kinds. These are placed between the ends of each two long cells often in pairs : the upper cells are thin walled and corky, the lower practically solid and silicified. Sometimes these short cells are in little groups, either because one long cell is absent or because there are several corky cells. The silica cells are usually uniformly squared, but the corky cells are less regular, and are sometimes elongated and hair like. There are comparatively few stomata in this part of the epidermis ; and the differences in the varieties con-

sist in the size of the long cells, and the number of the short cells and stomata. These differences are computed by counting the numbers in a square millimetre field.

As examples may be given the following. D 74 stands by itself in its small epidermal cells : there are 90 to 130 long cells to the millimetre and the number of short cells reaches 1112 or more : because of the numerous short cells the long cells are relatively short. As many as 14 stomata have been counted in a square millimetre field. In Louisiana Purple there are also a large number of short cells, their total area equalling that of the long cells. The number of stomata is on the other hand only one or two to the field. Yellow Caledonia is characterized by the partial or complete absence of the silica cells: stomata are quite rare, never more than one being met with in the field. In POJ 2714 also there are few silica cells, the long cells have thinner walls than usual, which makes them appear to be larger than they actually are, and many are filled with crystal sand. Stomata are rather common and often reach ten or more. The epidermis in POJ's with Chunnee as male parent have many elongated or pointed corky cells, and the general pattern is very irregular. Kassoer has a quite regular pattern, as have US 663 and US 833. Chunnee has small cells, but only half the number that D 72 has. *S. spontaneum* has large cells, few groups of short cells : silica cells are usually wanting, but stomata are comparatively abundant.

This paper is fully illustrated and includes a Table of characters considered useful in separating varieties, and a key for the separation of the varieties discussed. It is, we presume, a continuation of the two previous papers (more general in character) on the anatomy of the cane plant, referred to below ; and may be regarded as an attempt at applying anatomical differences of cane varieties and species to the difficult subject of their classification. Whether such assistance in classification is required or even desirable is a matter of opinion. For one thing, the anatomy of the plant can only be studied with the microscope in the laboratory ; and this removes it from the purview of the man in the field, who wants to know what particular variety he is growing. None the less, a clear view of the inner structure of the cane plant is necessary for the understanding of its life and growth, and it is by all means desirable that this knowledge should be obtained.

ANATOMY OF THE VEGETATIVE ORGANS OF SUGAR CANE. **Ernst Artschwager.** *Journal of Agricultural Research.* Vol. 30, No. 3, February 1st, 1925.

DEVELOPMENT OF FLOWER AND SEED OF SOME VARIETIES OF SUGAR CANE. **Ernst Artschwager, E. W. Brandes,** and **Ruth Colvin Starrett.** *Journal of Agricultural Research.* Vol. 39, No. 1, July 1st, 1929.

These two papers give a mass of information upon the internal morphology (anatomy) of the cane plant. They are abundantly illustrated with photographs and line drawings and each contains a coloured plate. The first was founded on a detailed study of the Louisiana Purple (Black Cheribon) cane, as a representative of the tropical or noble canes (*Saccharum officinarum*). The second paper takes two seedlings raised in the United States : US 875, Black Cheribon × *S. spontaneum*, and US 1694, Black Cheribon × *S. Barberi* (Chunnee variety).

These comprehensive studies are unfitted for abstracting, and their summaries would not convey much of the ground covered. The first paper gives a fully illustrated account of internal anatomy of the cane plant : under the headings stem, leaf sheath, ligule, leaf blade, root, and the development

of the apical region, with references to the scattered literature on these subjects. The second paper commences with a useful study of the anatomy of the floral axis, spikelets, and the development of the flower. The male and female organs are then studied under the headings macrosporogenesis and microsporogenesis, and the authors then proceed to anthesis of the flowers and pollination, fertilization and the development of the seed, and studies of seed and seed coat.

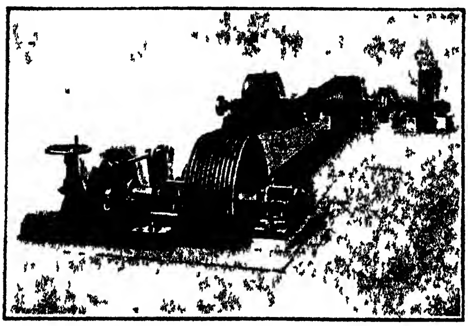
It is only in the introduction to the second paper that the scheme of this important work is laid before us. "The investigation presented in this paper is part of a comprehensive study of the anatomy, ontogeny, and the cytology of the sugar cane, undertaken primarily as a basis for further research in diverse fields including taxonomy, physiology, pathology, and genetics. The Office of Sugar Plants now has projects in all these fields, and it is proposed by the present series of studies to lay a foundation that will be useful in advancing them . . . It is recognized that, owing to the diverse forms of Saccharum, it is unsafe to generalize on the basis of a study of one variety or a limited number of varieties. Therefore the logical plan is to study a single variety in detail, and to follow this by comprehensive studies on the minute anatomy of selected parts, which will doubtless reveal differences that may be useful in helping to separate and identify species." It is unusual to attempt to allocate the portions contributed by different authors in a composite paper; but the addition of the second author (a cytologist) may be presumed to have resulted in strengthening the leading parts of the second paper, which deal with cytology.

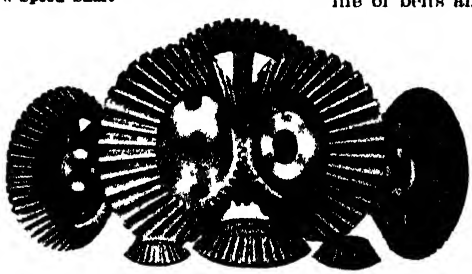
EXPERIMENTS IN THE RENOVATION OF OLD RATOON FIELDS OF CRISTALINA THROUGH REPLANTING WITH NEW VIGOROUS VARIETIES. **R. Menendez Ramos.** Fourth Annual Proceedings of the Association de Technicos Azucareros de Cuba, December, 1930.

In the year 1925 the possibilities were tested at Central Palma of supplying old fields of Cristalina with some newly imported seedlings, the idea being that the more rapid growth of these would help them to catch up the Cristalina stubble. If successful, this would do away with the costly and inefficient *mota* replanting in vogue: taking an old stool and cutting it into three or four pieces with two to three canes each and planting them—"a queer example of the colono's optimism," for most do not catch and if they do it is merely planting an old stool in a fresh place, added to the shock of separating it. Supplying Cristalina with Cristalina cuttings was a failure, being shaded by the older plants, often done too late, and no care being taken in weeding them. It was worth trying supplying with rapidly growing varieties put in at the earliest possible moment. SC 12/4, BH 10 (12), D 117 and others were tried first and appeared to be successful, and very soon the colonos' and administration fields were being thus replanted, especially by SC 12/4, of which it was written "because of its quick early growth and erect foliage . . . catching up with the ratoons even when replanted one or two months after cutting the field." Later the POJs introduced were experimented with in place of SC 12/4 because of mosaic, and POJ 2714 was specially successful because of its commerical immunity to this disease. In some cases old colonias given up by the farmers have been taken over and, at a cost of $150 to $200 per caballeria over the usual cost of cultivation, brought back to profitable cultivation.

The case of colonia Alambre in Central Santa Ana is described as of interest. This colonia is located on undulating hills with very good natural

See INTERNATIONAL SUGAR JOURNAL,
1930, pages 584-586.





drainage. The soil is mostly friable, ashy brown calcareous clay, on subsoils varying from cream coloured chalky clay to soft white lime carbonate or *coco.* Up to 1923 it was under small farmers growing corn, yams and the like. During 1923 and 1924 it was planted with Cristalina, with a total area of 9.618 caballerias (slightly over 300 acres) ; and the next five crops were, in arrobas per caballeria : 58,000, 55,000, 53,000, 41,000, 34,500 ; by this time it had over 60 per cent. mosaic infection. In 1928 re-planting with POJ 2714 was commenced and completed in 1929. Although the rainfall in this year fell to 33.88 ins., the crop reaped in 1929-30 was 56,700 arrobas per caballeria. "The old fields had complete stands, and appeared in excellent condition, everywhere the stools of POJ 2714 standing out as masses of dark green. Alambre really looked like a new colonia at the beginning of 1930. The cost of the replanting was $350 per caballeria." The author concludes "We believe money spent in this kind of work constitutes the best kind of investment for cultivation funds. Nothing will pay better, when anything pays in the cultivation of ratoon cane in this part of Cuba." This paper is illustrated by some striking photographs of successful replants of POJ 2714 in Cristalina ratoons.

PRELIMINARY REPORT OF A STUDY OF THE BIOLOGY OF *Lixophaga Diatraea.* **L. C. Scaramuzza.** Fourth Annual Proceedings of the Association de Technicos Azucareros de Cuba, December, 1930.

This Tachinid, known as the *Cuban Fly,* is the most important and effective parasite of the moth borer in Cuba, Porto Rico, and several other West Indian islands. In Cuba it is widely distributed throughout the island, being most abundant in spring, when 40 per cent. parasitism has been recorded. It has been introduced into Louisiana, Florida, Mexico, Antigua and Barbados, but all attempts at rearing it have failed and its life history has remained unknown. During the spring of 1930, the author devoted himself to its study, and this paper describes the progress made. The first attempt at rearing in small cages proving unsuccessful, larger ones 14 × 16 × 36 ins. with windows made of old films for observation, with free air circulation, in diffused light, at an average temperature of 85°F., were successful. Loaf sugar was found the most suitable food, and the interior of the cage was kept thoroughly moist ; and under these conditions flies were kept alive for forty days. On July 4th when 18 flies had been collected in the cage, five small larvae of *Diatraea* known to be parasite-free were introduced on small split pieces of cane, left exposed to the flies for three days, and then examined. Two were found to be parasitized, Lixophaga emerging from them in 14-16 days after exposure.

Dissection of gravid females showed that the larvae matured within the ovarian sac ; and the mature ones were successfully transferred to borer larvae with a small camel's hair brush, which they entered and then developed normally. They enter the borer at some tender spot, mostly between the segments, the borer evidently feeling their penetration and becoming violently agitated and trying to get rid of them. The first stage of the larva after entry is always found in the anterior part of its host, its caudal spiracles firmly attached to the main trachea by means of a heavily chitinized funnel. They remain in this position for one or two moults, after which they become free within the host's body without permanent respirational connexions. The borer larvae die before the emergence of the parasite (usually only one matures), all the tissues being consumed in small larvae, but a considerable portion remaining in a large one. The maggot emerges after tearing an opening in the skin of the borer. Pupation takes place within a few hours,

and the pupa remains quiescent for about 10 days. With refrigeration, this period may be prolonged to 30 days, an important point with regard to introduction to other countries.

Very little is as yet known about the habits of the parasite under field conditions, but the structure of its mouth organs suggests that it feeds on honey dew, which is always abundant on the surface of the canes. An experiment of placing newly born larvae near to the entrance of a borer tunnel was successful, in that as soon as it had discovered the opening it entered, and was found inside the borer within two to three hours.

The summary of the life history of *Lixophaga diatraea* is as follows: Pre-larvaposition period 6-7 days, larva stages within the host 5·5-13 days, pupal stage 9-11 days, total 20·5-31 days. Breeding is continuous throughout the year under Cuban conditions, and there are probably 8-10 generations, corresponding closely with the generations of the host, *Diatraea saccharalis*.

The Indian Sugar Industry.

The Tariff on Sugar Imports.[1]

The Indian import duty on sugar for revenue purposes has been continuously and rapidly increased in recent years, viz. :—

Before 1916	5 per cent.	
In 1916	10 ,, ,,	
,, 1921	15 ,, ,,	
,, 1922	25 ,, ,,	
,, 1925	Rs. 4-8 per cwt.	Specific on 23 D.S.
,, 1930	Rs. 6 ,, ,,	and above.

In 1920 the Indian Sugar Committee recommended that the *ad valorem* duty should be converted into a specific duty under normal conditions. This was given effect to in 1925 when the duty of 25 per cent. *ad valorem* was replaced by a specific duty of Rs. 4-8 per cwt. The Finance Act of 1930 enhanced these duties by Re. 1-8 per cwt.

The following table shows the rates of duty on various grades of sugar before and after March, 1930 :—

Sugar excluding Confectionery.	Duty Before March, 1930.	Duty. From March, 1930.
(1) Sugar, crystallized or soft, 23 D.S. and above	.. Rs. 4-8 per cwt.	.. Rs. 6 per cwt.
(2) Sugar crystallized, inferior to 23 D.S. but not inferior to 8 D.S.	.. Rs. 4 ,, ,,	.. Rs. 5-8 ,, ,,
(3) Sugar below 8 D.S. and sugar candy	.. *Ad valorem* 25 per cent.	.. *Ad valorem* 25 per cent. *plus* Re. 1-8 per cwt.
(4) Molasses	.. ,, 25 ,,	.. *Ad valorem* 25 per cent.
Tariff Values—		
Molasses—		
(*i*) Imported in bulk by tank steamer	.. Rs. 2-10-0 per cwt. 25 per cent.	.. Rs. 2-10-0 per cwt. 25 per cent.
(*ii*) Otherwise imported	.. Rs. 3-2 per cwt. 25 per cent.	.. Rs. 3-2-0 per cwt. 25 per cent.
Sugar Candy	.. Rs. 16-0-0 per cwt. 25 per cent.	.. Rs. 16-0-0 per cwt. 25 per cent. *plus* Re. 1-8 per cwt.

[1] Reproduced from the *Indian Trade Journal*.

Production of Plastics from Sugar.

Some particulars have already been published in these columns regarding new plastic materials which can be made, it is claimed, from " polymerized sugar "[1] " Sakaloid " is the name which has been given to this sugar plastic. It (or a form of it) can be made from sucrose, dextrose, levulose, molasses, and even sugar cane itself. Some further information is now given by the inventor ARTHUR S. FORD,[2] which in view of this possible commercial utilization of sugar is of not a little interest. He writes as follows :—

" Sakaloid, when first prepared, is a thick, highly viscous, elastic mass and this can be placed in solution for lacquers and varnishes, can be poured into moulds to set, can be die-cast, or can be processed further into elastic rubbery plates, sheets or rods, all of which take a brilliant polish and have all the appearance of the clearest quartz or glass.

" Rubba-Glas is the name given to this stage of the product and it is in effect a glass which can be cut, sliced or machined with ease. It is tough, elastic, and can be bent or twisted like so much rubber. This stage is controllable and can be rendered permanent by variations in manufacture so that the product remains permanently flexible and resilient. Its clarity permits the widest latitude of colour, a drop of concentrated dye in the mix resulting in a perfectly distributed tint.

"The next stage of Sakaloid is the hardened form, and when this is carried through we have the final brilliantly clear, quartz-like product. This is an ideal lens and optical material with a refractive index approaching quartz, a transparency to ultra-violet and infra-red rays, and with it all a material that can be drawn, machined or drilled in any manner. It is from this end-material that the moulding powder is made and this powder when hot pressed flows and forms like plastics of the familiar type, but the moulded piece is as transparent and clear as glass. Once this has been done the material ceases to be thermoplastic, heat serving only to harden the material further.

"Sakaloid in all its forms is absolutely unburnable. It give off no gases on exposure to flame. It does not melt ; even will not support a flame but simply chars when the heat of the flame grows too intense. For X-ray and photographic films of all kinds, Sakaloid offers many practical advantages beside being unique in its use for moulded cases and boxes where complete visibility of the contents is desired. Sakaloid can be sheeted for protective package purposes in any degree of thinness or thickness without losing its perfect clarity and of course it can be applied to paper or textiles for a host of purposes. Sak-a-tex is the name given to this branch of manufacture and a wide use of this line is indicated. Sak-a-lac is the type of material designed for varnishes and lacquers. Sak-a-tine is the name for the material when extruded into filaments for spinning and weaving as an artificial silk."

*** Assuming this plastic made from " polymerized sugar " to be all that is claimed for it, and assuming further that it were to take the place of all the materials at present used in the moulding industry in Europe and America, this would not absorb any very great quantity of sugar from the world's markets. A rough estimate would not suggest more than 100,000 tons. But we have considerable faith in the future of the moulding industry, which, one may add, is one of the very few which has made some little progress during the depression. So far plastics have been used for the production of small articles, mostly possessing special insulating properties ; but there seems little doubt that cheap plastics for the production of timber substitutes, such as

[1] *I.S.J.*, 1931, 375 and 513. [2] *Plastics*, 1931, 7, 448.

might be used in making furniture, for example, will be a development of the future. If it is true, as stated above, that a plastic can be made from molasses, this opens up the possibility of using that by-product (it may be with bagasse flour as filler, or in combination with the entire bagasse) for the production of boards or blocks locally on the plantation, employing a simple and inexpensive moulding plant.—ED., *I.S.J.*

The Sugar Industry in China.

Chinese Maritime Customs Report on Trade for 1930.

(Communicated by Walter Buchler.)

In common with other commodities sugar suffered during 1930 from the depreciation of silver and the lack of transport facilities in the interior. With the possible exception of the New York market, world prices did not fall during the period January to December, 1930, in the same ratio as silver and exchange, but, in spite of indications that, as a result, the demand for foreign sugar must slump heavily, statistics show that actual imports did not fall far short of those for 1929. These figures, however, fail to indicate the true position, as a considerable proportion of the imports for 1930 were represented by heavy arrivals during the first quarter of the year in fulfilment of large speculative purchases made during the summer of 1929. These speculative purchases, coupled with the overstocked position at the end of the year, had resulted in heavy losses to dealers, and so salutary was the effect that from January to June, 1930, buyers withheld from further participation in the market and import business in Shanghai in this commodity virtually ceased, while conditions in other parts of the country were to a large extent analogous. Towards the middle of the summer buying operations recommenced in the Shanghai area, but dealers decided upon a policy of caution, and forward purchasing was abandoned. In the main, this policy was adopted till the end of the year, merchants only purchasing quantities sufficient to meet immediate requirements, and this resulted in a sounder trading basis all round. In the late autumn the cessation of hostilities and the possibility of increased Customs tariffs considerably enlivened the market and a healthier tone prevailed, overshadowed momentarily in some ports, however, especially in Shanghai, by a proclamation that all accounts would require to be settled by the end of the solar year. Rumours in early December of an offer to the Government by a powerful combine of Cuban sugar interests for the establishment of a monopoly and the development of the sugar refining industry in China were not taken too seriously, and the market was affected but little. Brown sugar generally showed a decline, but whites from Hongkong registered an increase of approximately 25 per cent. while Japanese importations of the refined article almost recovered the position they had lost during 1929. The Middle Yangtsze offered a more fertile field than for many years, inordinate and suicidal internal taxation preventing arrivals of the native article in those districts which are usually supplied from the province of Szechwan. The outlook for the trade at the end of 1930 could not be considered an optimistic one. The comparatively low exchange rates ruling, in conjunction with the substantially increased import duties promulgated on the 29th December, appear likely to raise sugar prices in China to a level at which consumption must, of necessity, become adversely affected. It will be interesting to ob-

serve the effect of the new scale of import duties on sugar and the reclassification in three categories instead of two as heretofore, and whether these protective measures will result in increased revenue and at the same time nurture the native industry.

IMPORTS OF SUGAR INTO CHINA.

	1929		1930	
	Piculs.	H. Taels.	Piculs.	H. Taels.
Sugar, Brown	3,146,470..	17,987,190..	2,353,646..	13,861,746
,, White	7,790,573..	54,361,523..	5,548,291..	41,115,836
,, Refined	3,008,830..	21,355,663..	3,992,679..	27,678,407
,, White Cube and Loaf	35,527..	329,115..	26,121..	365,550
,, Candy	409,976..	4,109,608..	260,893..	2,612,890
Molasses	433,589..	616,942..	447,354..	718,341

1 picul = $133\frac{1}{3}$ lbs. 1 Haikwan Tael = { 1928 = 2/11$\frac{1}{16}$d. 1929 = 2/7$\frac{1}{16}$d. 1930 = 1/10$\frac{11}{16}$d. }

Buffalo Meeting of the Sugar Section of the American Chemical Society.

At the Buffalo Meeting of the A.C.S., held August 30th to September 4th, the Sugar Division had as its Chairman, J. K. DALE, and as its Secretary, E. W. RICE. Following are abstracts of some of the papers presented :—

Elimination of Thermophilic Bacteria from Refined Sugars. E. J. CAMERON and W. D. BIGELOW. Three major groups of thermophilic spore-bearing bacteria in the main dissimilar, but possessing in common the properties of high temperature growth and ability to produce spores of high resistance to heat, are of major importance as causes of spoilage in non-acid canned vegetables. In work done since 1926, it has been established that refined sugar may be contaminated with one or more of these major groups, and, under such circumstances, be a direct or indirect cause of spoilage. Tentative Bacterial Standards for Sugar for the year 1931 have been announced by the Research Laboratories of the National Canners' Association. At the present time, at least nine organizations engaged in the production of refined sugar have stated that they are prepared to furnish sugar which meets the standards.

Utilization of Low-Purity Cane Juices for making Syrups. R. T. Balch, C. A. FORT, and J. HAMILTON. If last mill juice could be utilized economically for products other than sugar, the "workability" of the higher-purity juices would be greatly improved. Such diversification of utilization would be particularly advantageous to the sugar cane industry of the continental United States. In experiments conducted on a semi-industrial scale, it was found that the low-purity cane juice from the last two mills may be made directly into a syrup equivalent, if not superior, to a first molasses for cooking or blending purposes, very little clarification being required. With more rigorous clarification, such as can be obtained by filtration with diatomaceous earth and vegetable carbon, a blending syrup of excellent quality was produced. The last run-off from the manufacture of white sugar by a vegetable carbon process was blended with the syrup from the treated low-purity juice to produce either an excellent table syrup or "cane cream." The latter is analogous in consistency to the product known as "maple cream" or "maple butter," which is made from maple syrup.

Further Experiments on the Modified Nyns' Method for Levulose. R. F. JACKSON and J. A. MATHEWS. It wa previously shown that NYN's reduction method for levulose in which the original specifications required a 2·5 hour period of digestion at 49°C. could be carried out satisfactorily at 55°C. in 75 minutes. This modification has been studied in detail. It is shown that if OST's solution is made to contain 25·3 g. of copper sulphate per litre, levulose-glucose mixtures containing 40 to 100 per cent. ratio of levulose to total sugar can be determined with a mean error of 0·35 per cent. : and those containing 15 to 40 per cent. with one of 2 per cent. The reducing power of glucose is shown to be essentially constant regardless of the concentration of either glucose or levulose and is equal to one-twelfth of the reducing power of levulose. A rapid electrometric method for the determination of cuprous oxide by di-chromate titration is described. Convenient methods of calculation have been devised.

Volumetric Determination of Pentoses and Pentosans. G. M. KLINE and S. F. ACREE. This paper presents the results of a study of the standard and steam distillation procedures for the formation and separation of furfural from xylose, a comparison of volumetric bromine methods and the gravimetric thicbartituric acid method for determining furfural, and the effect of various chemical substances and experimental conditions on the yield of furfural. The destruction or loss of furfural cbserved during the distillation of xylose with 12 per cent. hydrochloric acid according to the "standard" method is not avoided by the use of steam distillation. The precipitation and volumetric procedures show very good agreement for amounts of furfural greater than 0·01 grm. For smaller amounts the excess-bromine titration method of POWELL and WHITTAKER appears to be the most satisfactory. The distillation of furfural from a xylose-hydrochloric acid mixture by steam is practically complete when 400 ml. of distillate have been collected. The presence of nitric acid in the distillation mixture results in the loss of furfural. The best method of reducing this loss is the precipitation of the nitrates with nitrol.

Determination of Moisture in Syrups and Molasses. E. W. RICE and P. BOLERACKI. It has been found possible to produce such a thin film of syrup that drying to a constant weight is possible within two to four hours by placing the sample between two thin metal plates and applying pressure by means of a roller. This method is simple in operation and avoids possible loss of sample and long periods of heating which are the drawbacks in the generally accepted methods.

Glass Standards and the Duboscq Instrument in Sugar Colorimetry. J. F. BREWSTER and F. P. PHELPS. Colorimeters of the Duboscq type may be converted into limited spectrophotometers for sugar colorimetry by the use of the mercury arc with filters for isolating the lines of the mercury spectrum at wave lengths 435·8, 546·1, and 578 $m\mu$, and a glass plate calibrated for transmission at these wave lengths as a photometric standard. Such an arrangement permits the rapid colorimetric analysis of sugar products with satisfactory accuracy, the calculation of —log t at wave length 560, and the preparation and control of liquid secondary standards. Amber-coloured or the so-called smoke glasses are suitable for standards, but the amber is considered preferable for sugar colorimetry.

Java Technical Notes.

Tests on Vacuum Pan Circulation. **Werkspoor.** *Archief,* 1931, **39,** II, No. 32, 912-917.

A considerable literature on circulation in vacuum pans indicates not only its great value, but also that opinion on the influence of the design of the pan on circulation is by no means unanimous. Realizing that numerous questions relating to this matter cannot be answered by contemplation nor by long years of experience, Werkspoor decided to make trials on a small scale. In so doing, they were quite aware of the fact that none of the tests could give a decisive reply to the questions posed; still, as these tests conformed to some extent to works practice, they are worth publication. They were made in a

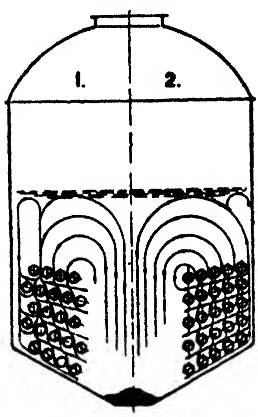


Fig. 1.

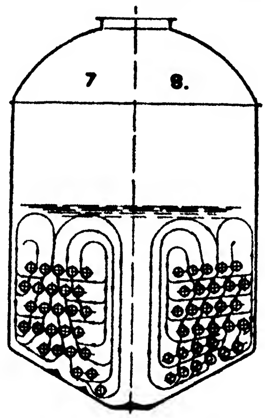


Fig. 2.

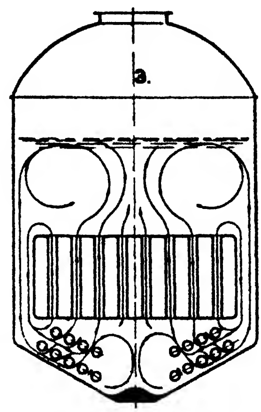


Fig. 3.

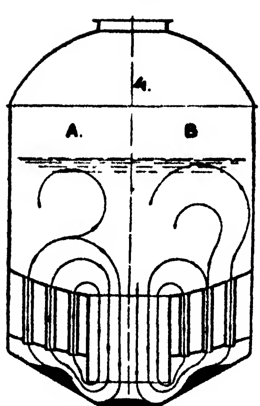


Fig. 4.

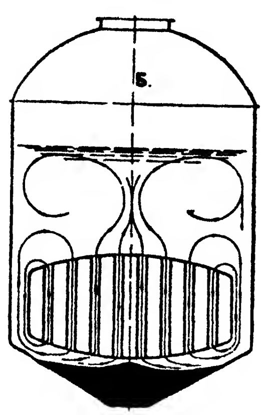


Fig. 5.

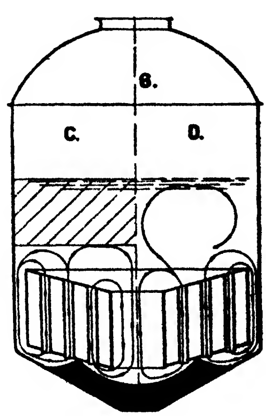


Fig. 6.

model vacuum pan, which had been vertically cut through and provided with a window so as to observe the circulation of its contents, the liquids tested being glucose syrup and very thick oil. In the imitated heating elements, small holes were bored, through which air could be blown into the liquid, the movement of which was accordingly affected. Steam could not be used for different reasons, and the currents produced are indicated in the diagrams herewith. In test 1 (*Fig.* 1), the coils were wound alternately right and

left ; and in test 2 (*Fig.* 1) they were all wound in the same direction ; but in both methods of arranging the coils the amount of dead space was the same. In the circulation schemes of tests 1 and 2 there is, however, a difference, as in winding the coils all in the same direction the distance between the body and the coils is not the same throughout.

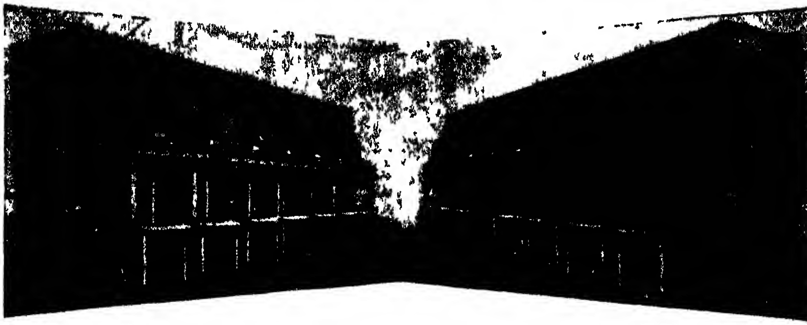
In tests 7 and 8 (*Fig.* 2) the lower coil was wound differently ; thus in test 7 all the coils are parallel, and in test 8 the lower coils are parallel with the bottom. In test 7 two dead spaces are seen which do not occur in test 8. In test 3 (*Fig.* 3) the apparatus had a detached steam drum with the coils under it, but the dead space here is about equal to that in tests 1 and 2. In test 4 (*Fig.* 4) the steam drum was fixed, and had a central circulation well. Here the dead space was larger than in the preceding tests, and besides there were parts (shaded in the sketch) where the circulation was not very lively. Above the steam drum the circulation was not always the same, altering sometimes during the test without it being possible to find the cause, the directions being shown in *A* and *B*. Without the central circulation well the dead space was much greater. In test 5 (*Fig.* 5) the apparatus was provided with a detached steam drum without any central circulation well ; but, as the sketch shows, the amount of dead space is here very great. Then in test 6 (*Fig.* 6) there was a detached steam drum with a central circulation well, which, however, had not been lengthened ; but according to this arrangement the circulation is very bad when the liquid is viscous. Further tests (which are not described here) clearly showed that when a circulation well is provided the amount of dead space can be much diminished.

TESTS WITH THE TEATINI PROCESS APPLIED TO CANE JUICE.[1] **W. Chr. Bedding.** *Archief*, 1931, **39**, II, No. 38, 1041-1049.

Preliminary in this article attention is called to the fact that 25 years ago PRINSEN GEERLIGS carried out tests with a method of working which (according to the author) resembles the Teatini process, though liquid SO_2 was not used. During the latter part of last season at the Poendoeng factory some tests were carried out with the Teatini process using liquid SO_2, the procedure being as follows : Raw juice was heated to 60-65°C., and limed to give a *pH* of about 12 (alizarin yellow and phenolphthalein being used as indicators) ; 1 kg. of liquid SO_2 was added in about 45 seconds, after which the juice was carbonatated off. Before the addition of SO_2, the alkalinity was 900-1100 grms. CaO per litre, and it was observed that a greater addition of lime to the highly buffered cane juice had no effect in raising the *pH*. The effect of the addition of SO_2 was immediately noted in the increased rate of settling of the carbonatated juice ; but the colour of the first carbonatation juice was darker than ordinarily, its normal pale-yellow colour having disappeared, while the press-cake assumed a distinctly greenish colour. Before the tests with the Teatini process were operated, the lime addition was 6·75 per cent. of milk at 20°Bé., but during the test it was possible to lower this dose to 4·50 per cent., though this gave an inferior cake. Eventually 5·75 per cent. was the figure arrived at, a reduction of say 15 per cent. in the consumption of limestone and coke.

Of course it might have been possible, the author remarks, to have lowered the lime to this figure without using the Teatini process at all, which is a point for decision in further strictly comparative tests. Summarizing his results, he says that his tests have proved that the precipitate obtained in the

[1] For information regarding the Teatini process refer to *I.S.J.*, 1931, 454.



"WESTON"

CENTRIFUGALS

OF ALL SIZES AND TYPES

Belt, Water and Electric Driven.

Our machines are of the latest design and fitted when necessary with all the latest Steaming, Washing and Spraying attachments

Self-Discharging Centrifugals

This type of machine has now become deservedly popular, and effects a considerable saving in time and labour in the Centrifugal station.

In most cases the Centrifugal Plant is the "bottle-neck" in the Factory or Refinery and the care of the management should be to see that a reputable make of Centrifugal is employed. Ours fulfils that condition, yet our prices are competitive.

Improved Electric Motors

for any duty and speed.

Patent Water Motors

with Interlocking Gear

Improved Spindle Bearing and Self-adjusting buffer.

All our plant is erected and clearly marked for re-erection before dispatch. We leave nothing to chance.

SEND FOR CATALOGUES:

POTT, CASSELS & WILLIAMSON,

MOTHERWELL — SCOTLAND.

FLETCHER PANS
ARE
MODERN

EXPERIMENTAL VACUUM PAN
FITTED WITH REFRACTOMETER
BUILT FOR
THE DEPARTMENT OF SCIENCE & AGRICULTURE, BARBADOS.

GEORGE FLETCHER & Co. Ltd.

DERBY CABLES AMARILLA, DERBY. **ENGLAND**

first carbonatation was improved as the result of applying the Teatini process, making it possible to diminish the quantity of lime by about 15 per cent. while realizing the same clarification effect. It was, however, noticed that the content of lime salts in the clarified juice and syrup was increased. There may be other advantages and disadvantages relating to the Teatini process ; but it was not possible in these few preliminarily tests to give a more definite opinion regarding them. Lastly, the author remarks that Teatini uses liquid SO_2 ; but he doubts whether this is altogether right ; and besides this there are other points in Teatini's original communication[1] which remain obscure. Some of the laboratory figures obtained with (*a*) the ordinary, and (*b*) the Teatini process, are as follows :—

Date.	Raw Juice. Brix.	Raw Juice. Pol.	Raw Juice. App. P.	1st Carb. Juice. Brix.	1st Carb. Juice. Pol.	1st Carb. Juice. App P.	Clarified Juice, mgms., SO_2 litre.	Pol. Press-cake.
Ordinary Method—								
10-11-30	16·91	14·04	83·0	14·48	12·62	87·1	118	0·26
10-11-30	16·65	13·77	82·7	14·46	12·51	86·5	117	0·24
12-11-30	16·90	14·12	83·4	14·87	13·07	87·9	119	0·29
13-11-30	16·77	13·98	83·4	14·66	12·89	87·9	124	0·29
Teatini Process—								
14-11-30	16·73	13·95	83·4	13·91	12·22	87·7	220	0·30
15-11-30	16·84	14·00	83·1	14·15	12·33	87·1	282	0·38
16-11-30	15·96	13·01	81·5	13·55	11·52	85·0	202	0·28

COMPOSITION OF A DEPOSIT ON THE CLARIFIED JUICE STRAINER. **H. W. van der Marel.** *Archief*, 1931, **39**. II, No. 38, 1050-1051.

Trouble was experienced with the frequent stopping up of the bronze sieve used for straining the clarified juice in the Klampok factory. This strainer is in two parts, one being used for the juice from the filter-presses. It was this same half that so frequently became un-usable owing to the formation of a slimy deposit, which at first appeared on that part of the gauze with which the stream of juice came into contact, though later extending over the whole of the half of the strainer. This deposit was examined with the following results : Loss on ignition, 44·9 ; and ash, 55·1 per cent., which mineral matter was found to consist of : 6·3 per cent. of Fe_2O_3 (and no Al_2O_3) ; 52 per cent. of CaO ; and 41·7 per cent. of P_2O_5. Calculating this P_2O_5 to tri-calcium phosphate it was found to amount to 90·8 per cent. In this connexion one may refer to a previous publication by the Experiment Station,[2] in which mention is made of a similar difficulty with a clarified juice strainer, in this instance made of German silver. This deposit appeared to have arisen in the same way. In the present case, in order to get a better idea of the conditions prevailing the juices were titrated with N/32 alkali using phenolphthalein as indicator, as the result of which determinations considerable differences in the acidity of these juices came to light, namely :—

Clarified juice	160-320 mrgms. SO_2 per litre
Filtered sulphited muddy juice ..	50-60 ,, ,,

While determinations of the lime salts by the soap test gave the following figures :—

Raw Juice.	Clarified Juice.	Filtered Juice.
220·1	289·4	753
180·7	300·0	704
215·6	386·2	719

all expressed in mgrms. of CaO per litre of juice.

1 *Loc. cit.* 2 *Archief*, 1917, I, 322.

It is a little difficult to see just what had happened, but as a possible explanation of what had occurred, it is suggested that the calcium phosphate had become precipitated in the filtered juice, as the result, it may be, of the presence of unslaked lime in the filter-cake, though in a considerable state of dilution; or it might have been present in a colloidal condition and have flocculated. Regarding its removal, it was found easy to clean the strainer with muriatic acid diluted 1 : 5, this being worked in with a strong brush, later rinsing with plenty of cold water.

SOME RESULTS WITH RAPID COOLING CRYSTALLIZERS. **P. Honig and W. F. Alewijn.** *Proefstation Mededeelingen*, 1930.

After some trials made with the Lafeuille rapid cooling crystallizer at the Goedo factory, samples of massecuites which had been cooled in this apparatus were kept at ordinary temperature, first in a small reservoir, and later in a laboratory crystallizer for several hours with continuous stirring. Favourable results were thus established. In some cases it was possible by this "after-mixing" to double the yield of crystal obtained by the Lafeuille cooling. At the same time the massecuite could be more easily cured, and the sugar obtained was less sticky, and of better quality. A considerably longer time of after-mixing, viz., 20 hours, gives a little more sugar, it is true, but, according to the results obtained a longer time than 4-6 hours would not appear to be economical. Results are shown in the table herewith. It is seen that in the case of the A_1-massecuite, an after-mixing of 4·7 hours gives a crystal increase of only 19·1-18·0, 1·1 per cent., a small advantage; but in that of the A_2-massecuite the figures are more advantageous, viz.: increase of 3·7 and 4·7 per cent. With the B-massecuites, however, by far the most favourable results were obtained, and some of these were exceedingly viscous after the Lafeuille cooling. Thus, the yield increased from 4·4 to 12·5 in 2-4 hours, and from 6·5 to 12·4 in 4-7 hours. Those strikes that show the smallest increase in the Lafeuille crystallization give the best results with the after-mixing, which result may be equal to or better than the Lafeuille result. It is probable that due to the greater viscosity of the massecuite, the speed of the crystallization in the Lafeuille is not able to keep pace with the increasing supersaturation, and there arises a great supersaturation, which of itself yet further increases the viscosity. A practical application should be made of this modification especially with B-massecuites. Exhaustions of 35° and lower for massecuites of 70° apparent purity should then be obtained with ease; and very viscous massecuites should give light-coloured sugars, only slightly sticky, on centrifuging.

	Analysis of strike on dropping from pan.[1]		Purity (apparent) of syrup after different periods of time.					Crystal increase in per cent. referred to the crystal before cooling.			
					After-mixing operation.			Through cooling in the Lafeuille	After-mixing operation.		
Kind of Massecuite.	Brix.	Purity (apparent)	Before cooling.	After cooling.	2—4 hrs.	4—7 hrs.	About 20 hrs.		2—4 hrs.	4—7 hrs.	About 20 hrs.
A_1	92·0	84·6	65·3	55·2	—	54·5	—	18·0	—	19·1	—
A_2	92·6	79·3	58·3	60·2	47·9	47·2	46·2	15·9	19·6	20·6	22·0
A_2	92·5	80·6	58·0	50·9	47·6	47·6	45·9	12·5	17·1	17·1	19·1
B	96·6	69·0	39·9	37·4	—	—	—	4.3	—	—	—
B	94·6	70·7	43·0	39·2	—	35·2	34·4	6·7	7·5	12·8	13·8
B	96·1	68·2	39·2	36·7	34·7	33·4	—	4·4	12·5	9·6	—
B	94·6	70·3	45·5	39·8	39·1	36·6	34·7	11·4	11·0	16·9	19·8
B	94·5	72·5	44·0	40·0	36·7	35·8	35·3	6·5	—	12·4	13·0
B	95·0	72·3	47·4	40·1	—	36·9	35·4	13·7	—	18·6	20·8

[1] It was warmed up at the most to 43°C.

Progress in Hawaii.

At the last meeting of the Association of Hawaiian Sugar Technologists several interesting papers were presented, abstracts of which we have prepared as follows :—

Loss in Recoverable Sugar due to Field Trash.

In a paper by S. S. Peck it was pointed out that there is no question as to the existence of such a loss, the difficulty being in establishing just how serious this may be. Trash brings no sucrose into the factory, but adds to the weight of the bagasse, and increases the losses due to the sucrose contained therein in proportion to the fibre in the trash. In the following Table I is given the composition of factory products as affected by increasing percentages of trash, and the losses due to lesser sugar output and increased labour costs :—

Table I.

Tons of Clean Cane	200,000	200,000	200,000	200,000	200,000
Tons of Trash	—	4,000	8,000	12,000	16,000
Tons Gross Cane	200,000	204,000	208,000	212,000	216,000
Tone Fibre Clean Cane	20,000	20,000	20,000	20,000	20,000
Tons Fibre Trash (50 per cent.)	—	2,000	4,000	6,000	8,000
Tons Total Fibre	20,000	22,000	24,000	26,000	28,000
Tons Pol. Cane	27,000	27,000	27,000	27,000	27,000
Tons Pol. Bagasse	400	440	480	520	560
Tons Pol. Mixed Juice	27,600	26,560	26,520	26,480	26,440
Tons sugar recoverable	25,000	24,962	24,925	24,887	24,850
Tons sugar lost	—	38	75	113	150
Value of Sugar lost	—	$2,280	$4,500	$6,780	$9,000
Days labour	160	176	192	208	224
Additional labour costs	—	$4,800	$9,600	$14,400	$19,200
Total loss	—	$7,080	$14,100	$21,180	$28,200
Loss per 1 per cent. trash	—	$3,540	$3,525	$3,530	$3,525

If the season is unduly extended there must be expected a deterioration of the quality of the juice in the cane as well as possible additional costs due to caring for the old cane; and further possible injury to the crop following owing to late starting. It is impossible to evaluate this with any confidence in the accuracy of the figures, but for purpose of expressing this it is assumed that for each day's delay in taking off the crop there is an average increase in the cane ratio of 0·01. Under such a condition, the results will be as in Table II.

Table II.

Trash per cent. Clean Cane	0	2	4	6	8
Days grinding	160	176	192	208	224
Tons cane per ton sugar	8·00	8·16	8·32	8·48	8·64
Tons of sugar produced	25,000	24,510	24,038	23,585	23,148
Tons of sugar lost	—	490	962	1,414	1,852
Value of sugar lost	—	$29,400	$57,720	$84,900	$111,120
Additional labour costs	—	4,800	9,600	14,400	19,200
Total loss	—	$34,200	$67,320	$99,300	$130,320
Loss per 1 per cent. trash	—	$17,100	$16,830	$16,550	$16,290

It is reasonable to accept that there will always be some trash accompanying the cane to the factory. Just what the unavoidable minimum should be is difficult to premise, so optimistically assume that cane with 2 per cent. trash does indicate indifferent work, but must be expected. Then taking as the basis of trash this 2 per cent. and still calculating that the cane will occasionally arrive at the factory without any trash, the losses and gain will be as follows :—

TABLE III.

Trash per cent. Clean Cane	0	2	4	6	8
From Table I	+$4,800	—	— $4,800	— $9,600	—$14,400
From Table II	+$34,200	—	—$33,120	—$65,000	—$96,120

That is, if payment is on the basis of gross cane containing 2 per cent. of trash on the clean cane, additional trash will cause a loss due to milling losses and additional labour of from $4,800 to $14,400 for 4 to 8 per cent. trash ; or from $33,120 to $96,120 if cane deterioration as well is included. On the other hand, whenever cane that is clean does appear, the gain will be from $4800 to $34,200 for the bases. It is suggested that if the labourers could be encouraged to better and cleaner work a part of the losses could be saved, and very possibly a part of the gain secured. The only strong incentive to which this class of men will respond is probably that of a pecuniary reward ; that is a bonus for better work, which should be accompanied by a penalty for poorer performance.

CONTINUOUS MUD FILTRATION.

ALLAN R. DUVALL[1] described progress made in this direction. In November, 1930, an experimental installation of two modified Oliver-Campbell drums was made at Olaa, but the use of wood proved unsatisfactory. A number of minor difficulties was also encountered, such as scale formation under the filter-medium, but these difficulties were permanently corrected. Metal construction only is now employed, and cotton-cloth is replaced with 00-perforated brass plate. At Waipahu the drums will be of a modified type with all the filtrate returning to the clarifiers, also employing a reverse blow of steam for discharge. At Kekaha the installation has given splendid results from the start in filtering all the settlings from 60-70 t.c.h. ; and so far the figures show : a cake pol. below 0·5 per cent. ; wash-water input well below 100 per cent. on the cake (having been several times higher with filter-presses); a negligible purity drop due to washing ; a filtrate which is far brighter than the clarified juice ; and operating labour requirements which have amounted to 1 Filopino per shift. At this same plantation the mud is re-pulped by allowing the cake to fall into a ribbon scroll conveyor, tank cars hauling this slurry to places where the soil is poor. Filtration tests made at different mills have shown that by controlling the ratio of fibre in the settlings all the mud so far encountered will filter at a good rate with good washing results. Settlings obtained at Kilauea when grinding Badilla cane were so slimy as to require a fibre ratio of 40 per cent., when they filtered easily and washed to 0·1 pol.

FILTRABILITY OF COMMERCIAL SUGAR.

During 1929 experiments were conducted at the laboratory of the Laupahoehoe Sugar Co. for the purpose of establishing the conditions in manufacture that lead to the production of a raw sugar which will have good filtering qualities in the refinery. Following are the conclusions which were arrived at as the result of these experiments :—Variation in the percentage of cane varieties ground from week to week does not produce a noticeable effect on the filtration characteristics of the sugar manufactured. Development of boiling methods so as to produce the maximum proportion of sugar from high purity massecuites results in an improvement in filtration efficiency. The quality of the low grade sugar returned to process exerts an influence on filtrability.

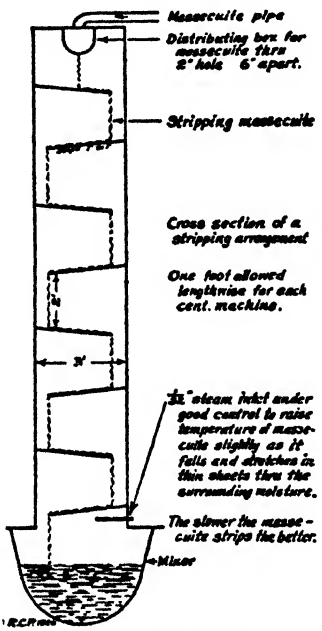
[1] Local representative of Oliver United Filters, Inc.

Progress in Hawaii.

As the filtration efficiency of syrup is much higher than that of remelted low grade sugar or molasses, consequently the proportion of syrup, remelt, or molasses boiled in a strike will influence the filtration efficiency of the sugar derived from that strike. Increasing the polarization of a sugar by washing in the machines to a higher polarization increases its filtration efficiency. Large grained sugar has a higher filtration rate than small grained sugar. Storing under proper conditions has little effect on filtration. Increasing the *pH* of syrup by addition of soda or lime solutions appears to depress the filtration efficiency. Filtration efficiency of syrup is lowered by allowing syrup purity to be decreased by partial inversion. Filtering syrup through kieselguhr makes a marked improvement in its filtration efficiency; whereas, if no filtering aid is used, little change in the filtering rate can be observed.

Handling of Low Grade Massecuites.

G. F. Murray drew attention to a method of handling low grade massecuites which was originated by R. C. Pitcairn,[1] and used for a time at the Wailuku Sugar Co., the Hawaiian Commercial and Sugar Co., and the Hamakua Sugar Co. It will be of particular assistance to such places that have like here at Paauilo a viscous, slow drying low grade, or a shortage in centrifugal capacity. The installation consists of a tower 30 ft. high with a cross section inside of 19 by 15½ in. Beginning 12 in. below the top, baffles are so arranged at three-foot intervals, that the massecuite follows a zig-zag path down, discharging directly into the magma pump, which elevates it to the mixers. Cold massecuite enters the top of the tower, is delivered to the top baffle mounted in the centre of the tower, which divides the massecuite into two streams which drop 3 ft. to two 4 in. baffles, mounted one on each side of the tower. These two baffles deliver the massecuite to the next baffle, mounted in the centre again, and so on down the length of the tower. All baffles are set at an angle to keep it from running down the sides of the box. Directly under the bottom baffle, live steam is introduced through a ½ in. line. Steam rising in the tower comes into intimate contact with the thin sheets of massecuite, warming same. By regulating the amount of steam, any temperature up to 70°C. may be had, although above 50° results in excessive dilution and a higher molasses purity. Massecuite coming from the warming tower is much freer and less viscous to the feel. It is lighter in colour due to included air, but this apparently does not affect the drying. The remelt purity has increased from 74·5 for 1930 to 79·2 for 1931 (19 weeks). The greatest gain has been in speeding up the drying and increasing the remelt purity. Low grade in process has been reduced 50 per cent. To secure the maximum benefit from this equipment



Cross section, showing 8 strippings inclosed in 1" board housing, massecuite flowing over board strippers.

[1] See *I.S.J.*, 1920, 525.

care must be exercised that the smallest amount of massecuite possible be kept in the mixers, as it cools off rapidly and most of the advantage is lost.

Press-Cake Washing.

R. F. Puckett stated that the Laupahoehoe Sugar Co. washes their press-cake for 5 hours, sending the first hour's washings to the evaporators, and using the balance for maceration. So as to ascertain the optimum period of washing, various determinations were made on the sweet-waters, the average results of which were :—

	Minutes 3 to 4	Hours 1	2	3	4	5
Brix	9·60	2·70	1·60	1·20	0·90	0·70
Pol.	8·00	2·11	1·21	0·86	0·59	0·43
Apparent Purity	83·30	78·10	75·60	71·70	65·60	61·40
Per cent. Non-Sugars	1·60	0·59	0·39	0·34	0·31	0·27
Per cent. Recoverable Sugar (*a*)	7·23	1·82	1·01	0·69	0·43	0·29
Non-Sugar per cent. Recoverable Sugar	22·10	32·40	38·60	49·30	72·10	93·10

(*a*) Based on Sugar purity 98·5, Molasses purity 34·0.

For the 10 weeks preceding and during these tests the average pol. of the press-cake was 0·78; and when the time was reduced from 5 to 4 hours the average figure for a similar period was 0·83. Per cent. recoverable sugar is of course a calculated figure, and undoubtedly the actual one would have been much lower, since inversion must occur in the low-density washings. It will be noted how rapidly the non-sugar per cent. recoverable sugar increases after the 4th hour of washing. It is clear that water having a Brix below 0·7–0·8° only contains negligible amounts of recoverable sugar, so that washing beyond that point would appear to be useless, and even detrimental. Observation of the Brix of the washings furnishes a fairly good indication of the time that washing should be continued.

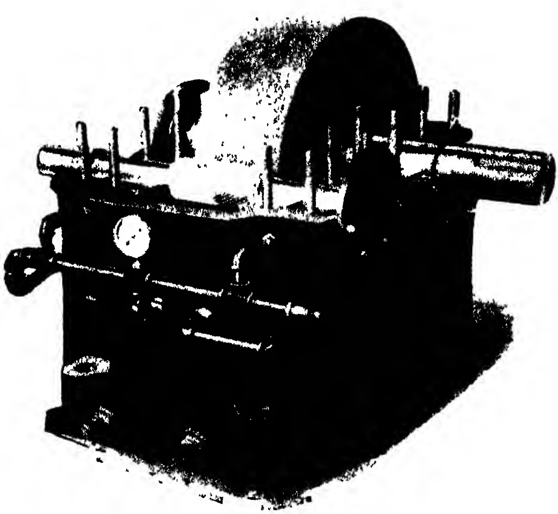
Fire Protection for Sugar Mills.

After the last fire at Waialua, wrote G. L. Trist, a very careful survey of available water supply for fire fighting purposes was made, and mains large enough to furnish a sufficient supply of water at 125 lbs. pressure were installed in and around the mill and warehouse property. Outside piping was arranged to form a loop system. Indicating shut off valves were located at various points throughout the property making it possible to have only a small section of the system out of order for repair at any one time. The system was equipped with double relief valves to guard against excessive pressure, double hose hydrants being conveniently located throughout the property. The outside hydrants were equipped with 2½ in. Honolulu Fire Department standard fittings throughout, making outside assistance possible should the occasion arise. All hydrants were located at least 50 ft. from any building. One special hydrant has been installed on a large pipe line furnishing water from a pump located about a mile from the mill. This hydrant was equipped with a 4 in. suction. In the event of the mill fire pumps being out of commission, it would be possible for a pumping engine to connect on to this suction and by-pass into the system maintaining pressure. The writer feels that high pressure permanently located stand pipes or play pipes with 1⅛ in. or 1¼ in. nozzles conveniently located throughout the property capable of reaching the highest points of roofs are a very valuable asset to a factory fire fighting system, especially where there are wood or tar and gravel roofs, and around lumber yards and bagasse piles. One man only can handle one of these pipes

at 125 lbs. water pressure and it is possible to swing it in almost any direction. They are more expensive than the hydrants, but only in the first cost; the maintenance is practically nil, as no hoses are required. These pipes are always ready for service. By simply opening the valves the fire can be fought at once, and much valuable time is saved. Where it is possible, the fire pumps should be located away from the factory, one steam driven, and the other (for use in the off season) electrically driven. A small fire fighting crew should be chosen from men engaged in the mechanical and electrical departments of the factory, and therefore quite familiar with the surroundings.

High Speed Gear Units.

A power transmitting and speed transforming mechanism for a steam turbine, a Diesel engine, or a gas engine is an important piece of equipment. It should be of the same high quality as both the engine and the driven machine. Gear drives for this purpose and similar purposes in the past have occasionally been troublesome. During the last few years, however, the technique of gear manufacture has been so much improved and, due to much intelligent research work, the characteristics of gears together with their load-carrying capacity when used for both speed increasing and reducing are now so well understood that the manufacture of a completely satisfactory unit for use with a steam turbine, a Diesel engine or a gas engine no longer presents any difficulties.



Standard industrial gear units are designed for use with electric motors running at a maximum speed of 1800 r.p.m., and they are suitable for reducing speed but not for increasing speed, and for tooth velocities not exceeding 2000 r.p.m.

When a gear unit is required for connexion to a steam turbine or for any other purpose where the speed of the pinion shaft is over 1800 r.p.m., it has been considered special. Now, however, the Farrel-Birmingham Company, Inc., Buffalo, N.Y., has developed and standardized a series of gear units suitable for speeds up to 6000 r.p.m. and powers from 120 h.p. to 2500 h.p., with ratios up to 10 to 1 for either increasing or reducing speed.

The accompanying illustration shows one of these gear units with the cover removed to show the gears, which are of the Farrel-Sykes herringbone continuous tooth type with accurately generated continuous teeth.[1] The proportions of the gears, as regards number of teeth, pitch, face widths, diameters, depth of tooth, helical angle, etc., are chosen on a scientific basis and with

1 In generated gears the gear, while being cut, revolves in practically the same way as it does when in operation, the cutter acting in the same manner as the pinion.

special consideration as to whether the gears are to be used for increasing or decreasing speed.

A complete lubrication system is provided, consisting of forced lubrication to all bearings and spray lubrication for the gear teeth. The gears are not allowed to run in a bath of oil, but the small amount of power necessary to drive the gear pump is less than the amount that would be absorbed by churning oil. As will be seen from the illustration, the gear unit is self-contained, having its own lubrication pump, oil tank, cooler where necessary, the lubricating fittings consisting of a pressure gauge and a relief valve.

Points claimed for these gears are their exceptional accuracy which eliminates necessity for axial float; their rigidity and proper proportions which minimize vibration and ensure durability; a mechanical efficiency of from 98·3 to 98·9 per cent. when used for reducing speed and from 97·5 to 98·0 per cent. when used for increasing speed; silent operation; and large factors of safety.

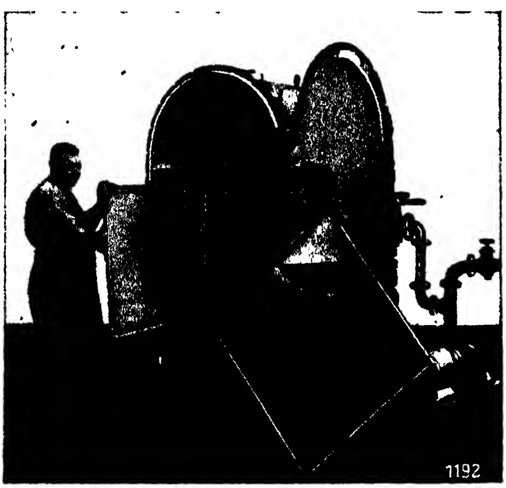
Beet Factory Technical Notes.

Fractional Liming.—An article by JIRI VONDRAK, of the Prague E.S., entitled "The Influence of Liming on the Filtration of the Carbonatated Juice" deals with the effect of adding the CaO in two fractions, as in the TEATINI, KOWALSKI and KOZAKOWSKI,[1] and certain other processes, as compared with the usual method of adding the lot at one time. SPENGLER and BÖTGER[2] have made a notable contribution to this subject, to which Prof. TEATINI has made a reply,[3] but they devoted their attention to the effect of the treatment on the composition of the juice. Now the present author goes a step further; he gives figures for filtration tests; and he establishes optimum conditions for fractional liming. Using the miniature diffusion battery and carbonatation outfit designed by STANEK and SANDERA,[4] and operating on 2000 grms. of juice in each experiment, he worked as follows: Heated to 85°C., limed, carbonatated for 5 min., and filtered in a laboratory press under a constant pressure of 2 atmos. In the first series of tests, Experiment 1 was with 1 per cent. of CaO added in one dose; but in subsequent tests the amount was divided, only 0·15, 0·30 and 0·5 per cent. being added to the heated juice in Experiments 2, 3, and 4, and the balance making up the 1 per cent. (0·85, 0·70, and 0·5 per cent.) after 2 minutes' mixing. Quite striking results were obtained. In Experiment 1 the volume of filtrate collected in 5 min. was 930 c.c. but in Experiments 2, 3, and 4, the amounts were 1260, 960 and 860 c.c., in the same time. Thus it is seen that a favourable rate of filtration only occurred in Experiment 2 (0·15 and 0·85 per cent.), the rates in Experiments 3 and 4 being hardly different from No. 1. Further, the quotient was highest in Experiment 2. Hence it is proved that splitting the dose of lime distinctly improves the filtration of the carbonatated juice; but at the same time it is clear that the division must not be arbitrary, since it must depend on the nature of the juice. Something else was noticed. This was that both after liming, and also after carbonatation, the volume of the precipitates was not the same in all the experiments. It was least in Experiment 2, i.e., in the liquid filtering most rapidly, and largest in No. 4, the slowest. In a second series of experiments the time factor was studied, a certain time being allowed to elapse between the addition of the 0·1 per cent.

[1] Austrian Patent, 11,361 of 1902; see GRÖGER'S "Vade-mecum" III, 1911, 350-354. See also Austrian Patent, 42,044 of 1909.
[2] *I.S.J.*, 1931, 330. [3] *I.S.J.*, 1931, 454. [4] *Zeitsch. Zuckerind. Czecho-slov.*, 1928-29, 129; 1929-30, 37.

and the 0·9 per cent. doses of CaO. It was found that the greater this interval of time, the faster was the rate of flow, the volumes collected being 450, 460 and 510 c.c. after 0·1, 2 and 7 minutes respectively. Another factor studied was the temperature to which the juice is heated before receiving the first fraction of lime, viz., 20, 40, 60 or 100°C., and this was found to be of some importance. Easily the best results were obtained with 100°C., the time required to obtain 1000 c.c. to filtrate in these 4 experiments being 4·8, 4·4, 3·6 and 2·6 minutes. Juice which had been limed with 1 per cent. in one dose took as long as 7·1 minutes. In fact to heat only to 20°C. was seen to cancel the advantage of fractional liming altogether. In yet another series of tests, the use of 2 per cent. of CaO also added fractionally was investigated ; but while additions of 0·2 + 1·8 per cent. gave a better result than 0·1 + 0·9 the difference was not so very much greater, being 1440 as compared with 1130 c.c. It would seem probable therefore that each juice has its optimum total lime addition. Altogether these results add to our knowledge of fractional liming, which itself forms an advance in the practice of beet juice clarification.

Seitz Filter.—Some further particulars are now given of this apparatus which is being recommended for the filtration of evaporator syrup, remelts, and the like. It consists essentially of a closed casing with lateral door. Inside the casing vertically juxtapositioned are flat filtering elements, which are covered on both sides with extremely fine wire gauze. Previous to operating the filtration proper, a thin layer of a special filtering medium, consisting mainly of fine-fibred asbestos, is deposited on the gauze. This forms the filtering surface, neither cloth nor paper being used at all. This filtering medium is capable of repeated regeneration, so that the cost of its use works out at a minimum. In the filtration of beet factory evaporator syrups (thick-juices), the filters have to be reset after about 8 hours ; for the first setting 150 grms. of the filtering medium are required per sq. yard, and for subsequent settings 20 to 30 per cent. of fresh material is added to that which has been regenerated. It is stated that the Seitz filter is particularly advantageous for use in activated carbon refineries, using liquors at about 60° Brix at a temperature of 80-90°C. In general it is claimed that this apparatus has greater capacity in gallons per sq. ft. per hour than filter-presses or bag filters ; that its working costs are very low ; and that it is simple to manipulate, the filtrate leaving through one outlet only.[1] It appears to be an apparatus worth consideration for several uses in the beet sugar factory and refinery.



SEITZ FILTER (Experimental Type).

Devitrification of "Drops."—Confectionery articles of the type of fruit drops retain their glassy appearance unchanged for a long time if kept in closed vessels or in the presence of some deliquescent material. But on standing

[1] *I.S.J.*, 1931, 455.

in the open air for a time they undergo a change, which commences on the surface and penetrates inwards. They lose their hardness and brittleness becoming converted into softer masses of matty white appearance, changing in fact from a transparent to an opaque crystalline mass. It is known that this alteration is caused by atmospheric moisture, being also accelerated by the hygroscopic fruit acids present. Indeed the change appears analogous to the devitrification of ordinary glass. Samples which had undergone the alteration under consideration were examined by Röntgen rays, which offer the most certain means for identifying the crystalline state, permitting one at once to recognize the re-crystallization taking place on the surface. Six photographs (not shown here) were made by the authors, F. HALLA and E. MEHL,[1] showing the results obtained with the copper-K radiation in a camera having an effective radius of $r = 28{\cdot}76$ mm. No. 1, shows a thread 1 mm. diameter freshly taken from the boiler, no signs of re-crystallization being exhibited, the so-called amorphous ring, characteristic of amorphous substances, appearing in the middle of the picture. No. 2, made from the same thread after keeping it out of contact with air in the presence of caustic lime, is just the same. No. 3, on the other hand, is a thread which had been exposed for 3 days to moist laboratory air, the Debye-Scherrer interference rings, characteristic of crystalline substances appearing. No. 4 shows crystalline sucrose, and its similarity to the previous picture is marked. No. 5, made from the glassy interior of a raspberry drop, is similar to Nos. 1 and 2. No. 6 was taken from the surface of the devitrified raspberry drop, and here the interference rings are again seen.

Research Prizes.—One of the German technical periodicals organizes a competition for technologists, prizes being awarded by a Committee to candidates for essays on problems connected with beet sugar manufacture, and following are some of the problems which have been set for 1931/32 by Dr. H. CLAASSEN. "Determination of the Loss of Sugar in the Flume and Wash Waters." No methodical investigations on this subject have been made for about 40 years, though methods of handling roots have changed rather much. "Influence exerted by Intense Extraction of the Slices." It would be of interest to ascertain the amount and nature of the substances which are extracted from slices on further treatment with water. "Alkalinity during Gassing." It should be determined whether during carbonatation the alkalinity of juice samples taken from several parts of the tank at the same time differs, and if so to what extent. "Continuous Carbonatation." So far no experiments have been made on the behaviour of the mixture of juice and scums during continuous carbonatation; it is to be expected that quite different conditions obtain, especially in respect of the formation of double compounds. "Colloid Elimination." One might experiment on the precipitation of the colloids of beet juice at different *pH* values, observing whether this is rapid or gradual; further, whether on later changing the *pH* value the flocculate again dissolves or clots. "Filter-cloth Life." Several factors affecting the life of the cloth, taking into consideration the nature of the cloth, its weave, the kind of press, the pressure used, the temperature, the alkalinity, and the like, are worth study. "Sulphitation." A point to be examined is how much of the SO_2 introduced in thin-juice sulphitation reaches the molasses in the form of sulphites. "Vacuum Pans." SCHLOSSER's experiments on the effect on colour and form of crystal of the heating elements in pans might be continued.

[1] *Zeitsch. Zuckerind. Czechoslov.*, 1931, 55, No. 42, 551-553.

Abstracts of the International Society of Sugar Cane Technologists.

Under the scheme instituted by the I.S.S.C.T. a collection of abstracts of papers on agricultural and technical subjects is prepared monthly. A selection from these "Sugar Abstracts" has been made by us, and appears below :—

BEET SUGAR MANUFACTURE.

PREVENTING LOSS OF HEAT IN CENTRIFUGING. **U. M. Zhvirblyanskii and I. I. Nevstrueff.** *Zhur. Sakh. Prom.*, 1930, **4**, Nos. 9-10, 707-709.

A 42 in. Weston centrifugal was encased in a heat-insulating covering, consisting of a layer of hair felt held in place by a wooden jacket, similar coverings being also provided for the top and bottom, while the syrup pipe was closed during operation to prevent outward passage of air. By this means it was aimed to present as far as possible loss of heat from the massecuite and the purging steam. A saving of about 16 per cent. of the total cycle time, and a reduction of 25 per cent. of the steam, resulted. Further, the yield of sugar from the massecuite was raised from 43 to 44·1 per cent.

ELECTRIC SIGNAL SYSTEM FOR OPERATING CHEMICAL CONTROL. **S. Sliwinski.** *Sucr. Belge*, 1931, **50**, 345-353, 365-373.

The Polish Sugar Institute, Warsaw, has elaborated a system of automatic signalling for indicating whether any station or apparatus is functioning normally or otherwise. Figures obtained in the chemical laboratory are flashed on the left hand side of the signalboard by a special electric signalling device (here fully described), e.g., Brix, sucrose, akalinity values of various products. Space is also provided on the right-hand side for temperatures, e.g. of diffusion water, carbonatated juice, juice-heaters, evaporators. So long as the temperature at a given post remains normal the signal remains unilluminated, but should it fall below the minimum, or rise above the maximum, coloured lights are shown. The middle panel of the board is the "work register" to show the performance of an apparatus up to a given point of time during an 8-hour shift. If, e.g., beets are being weighed in at the standard rate a ribbon over a slit rises *pari passu* with that of the standard scale ; but if there has been delay, its column of light will be correspondingly shorter. Thus the superintendent can at a glance see what posts are slack.

EXPERIMENTS ON LIME KILNS. **I. I. Chernobilskii.** *Naukovi Zapiski*, 1931, **12**, Nos. 1-2, 94-145.

This is an extensive study of two types of lime kilns : the Antonoff and the Isserlis, the first-named of which is given preference. Both are fully described with the aid of numerous detailed drawings and charts, the engineering data covering 27 pages.

COMPOUNDS OF SUGAR AND LIME. **J. Doubourg.** *Bull. Assoc. Chim. Sucr.*, 1931, **48**, 297-306.

When lime is brought into contact with sugar juice, it becomes progressively covered with an insoluble crust, the formation of which is the more rapid the higher the temperature. When the crust entirely covers the particles of lime, an equilibrium is established with the sucrates which have passed into solution, the quantity of which is therefore greater at low than at high temperatures. Any means that will delay the formation of the crust will enable more lime to go into solution. Liming at low temperature does this. Thus if an equilibrium between the soluble and insoluble sucrates in the juice is established at 20°C. and the juice is subsequently heated to 80°C., it will contain more soluble lime than if the juice had been limed at 80°C. One result of cold liming is, therefore, that the juice contains a greater proportion

of soluble lime, and consequently a greater volume of precipitate is obtained when the juice is carbonatated.

DECOLORIZING SECOND RAFFINADE SYRUPS WITH ACTIVE CARBON AND CHAR. **A. A. Ragozin.** *Zhur. Sakh. Prom.*, 1930, **4**, 653-661.

Comparative experiments indicate an advantage in a combination process in which the second raffinade syrups are first filtered through a vegetable carbon and then through bonechar. These two decolorizing agents supplement each other, that is, the less effective one is on certain colouring substances, the more so is the other.

ADSORBING POWER OF ACTIVE CARBONS. **M. Garino, P. Dufour and G. Santomauro.** *Ind. Sacc. Ital.*, 1931, **24**, No. 9, 300-303.

Experimenting with seven vegetable carbons and two bonechars, the general conclusion is that the total quantity of substance adsorbed from beet molasses is independent of the quantity of colouring matter eliminated. Carbons of small decolorizing power may still adsorb larger amounts of other substances than other carbons of greater d.p. Bonechars and chemically activated vegetable carbons adsorb a total quantity of substances having an average nitrogen content of 7·5 and 8·0 per cent.; but the heat-activated carbons those having 10 per cent. or more.

SWEETENING-OFF THE FILTER PRESS. **V. Stanek.** *Zeitsch. Zuckerind. Czechoslov.*, 1931, **55**, 443-451.

A new process of sweetening-off carbonatation press-cake is done through both the juice and the water inlets simultaneously. The juice line is used to introduce a 10 or 15 per cent. suspension of carbonatation mud at a slightly greater pressure than that existing in the water line, the object being to prevent the formation of cracks and channels by the sweetening-off water. Operation of the press can be accelerated by this method because by keeping cracks filled all the water is forced to go through the cake and thence the sugar is sooner removed. Another advantage is that a smaller quantity of water is needed for the sweetening-off operation.

CANE SUGAR MANUFACTURE.

RECENT INVENTIONS RELATING TO THE CANE MILLING STATION. **R. J. Spoelstra.** *Archief*, 1931, **39**, 579-594.

The author reviews certain American and Dutch patents having to do with improvements in cane crushing installations. These include the Morgan cane disintegrator, Meinecke cane knives, an arrangement for preventing the accumulation of cane particles under crusher rolls, an apparatus for the continuous maceration of bagasse, one for the repeated and rapid imbibition of bagasse on the intermediate carrier, a new type of the De Bruin mill, and a forced feeding device for mills.[1]

TEST WITH THE VACUUM PAN REFRACTOMETER. **W. F. Alewijn.** *Archief*, 1931, **39**, III, Mededeelingen, No. 17, 639-684.

The author used a *Zeiss* factory refractometer for the purpose of observing the phenomena that occur during the pan boiling of cane massecuites. Tho instrument and its use are fully described and illustrated, and the conclusion is reached that it is the best of all hitherto proposed helps for controlling boiling, and for obtaining data on which to base instructions to panmen. However, its use should be supplemented by that of a microscope in order to control the size of grain and to study the causes of secondary grain formation.

[1] All these will be found fully described and illustrated in DR. FRANCIS MAXWELL'S forthcoming work "Modern Milling of Sugar Cane," which MR. NORMAN RODGER hopes to publish in December.

Publications Received.

Geschiedenis van de Wetgeving op de Beetwortelsuiker in de verschillende Productielanden der Wereld en haar Invloed op de Productie en de Consumptie. Dr. H. C. Prinsen Geerligs. 234 pages; 4 plates and a map. (J. H. de Bussy, Amsterdam). 1931. Price : 6 guilders.

Dr. Geerligs has combined in a compact volume the figures and data which have been gathered by him during his work in connexion with the 1929 Session of the Economic Commission of the League of Nations, with his attempts to chart a revised version of the Brussels Convention of 1902, and with his work as adviser to the Committee for the Chadbourne plan. The voluminous material collected in all these investigations has been thoroughly revised, completed, and classified, and has been extended by data from other countries outside the League of Nations, the Brussels Convention, and the International Agreement. Altogether 41 countries are mentioned in the book, these comprising every spot on the globe where beet sugar is produced on a commercial basis. After a clear and concise review of the history of beet sugar, beginning with the discovery of sugar in beets by Marggraf in the year 1747, up to the signing of the International Agreement in Brussels on May 9th, 1931, the author describes the history of beet sugar in the individual countries. His work is very complete, and gives considerable historical and economic data, technical matters, however, not being considered. In it the reader will find exhaustive tables on production, consumption, yield of sugar per hectare, duties and excises, premiums, and is hardly likely to be disappointed when searching for information on any point properly within the scope of the volume. It is certain to be found of great value to students of the economics of sugar.

Tables giving Sugar Content and Purity of Juices. Jerzy Zaleski. (Institute for the Sugar Industry of Poland, Warsaw). 1931. Price : 25s. (bound in cloth).

These tables are based on a normal weight of 26·00 grms. and the metric c.c. for Brix readings from 8·0 to 30·0° with a juice dilution of 100-110 c.c. and a polarization interval of 0·1°. They supersede the compilation of Slaski and Wasilkowski, heretofore used in Polish beet factories, which were based on the 26·048 grm. weight and the Mohr c.c. In compiling them the sucrose content is calculated from the formula $\frac{1{\cdot}1 \times p \times 26}{99{\cdot}7174 \times d}$, p being the polarimeter reading, and d the density of the juice at 20°/20°. Explanatory reading matter is printed in English, French and German. They should prove generally useful.

Lexique des Terms sucriers en 12 Langues. By Roman Shemenesky. (*La Betterave*, 15, rue Theodule, Paris). 1931. Price : 75 francs.

The languages concerned are : English, German, French, Spanish, Portuguese, Italian, Dutch, Hungarian, Polish, Swedish, Czech, and Russian; and the terms (though not very numerous) are those mostly in use in the sugar laboratory, the factory, and the field. There is a special nomenclature relating to cane factory machinery, English-Spanish, and Spanish-English; and a section on weights and measures, engineering values, and other useful data. The book is well printed, and attractively bound, and its author is to be thanked for giving us an international dictionary, which though small will be found useful by many.

Mass Production. By the Right Hon. Sir Eric Geddes, G.C.B. (Pelican Press, Carmelite Street, London). 6d.

A tract for the times in which the author, the Chairman of the Dunlop Rubber Company, declares that, while we in the United Kingdom may have been dilatory in protecting our industries under the old factory system, further delay will be suicidal under the revolutionary system of mass production; and he illustrates his theme with diagrams and arguments to show the vastly cheaper cost of mass production.

Brevities.

Arrears of Sugar Factory Maintenance.—Mr. E. W. Kopke, President of the Fulton Iron Works Company, lately expressed the opinion that the arrears of maintenance in sugar factories throughout the world, as a result of recent unprofitable crops, must amount in value to as much as $36,000,000. This volume of business awaits the ability of sugar factory owners to purchase, and with improving sugar prices a substantial portion should be available in the next year or two.

It is now certain (wrote the *Times* on November 4th) that an early attempt will be made by the Governments of the Empire to co-operate in a common effort to overcome the economic difficulties which beset them all. Mr. Bennett has made the welcome announcement that the Canadian Government is taking immediate steps to bring about without delay a meeting of the Imperial Economic Conference, and his announcement has been followed almost immediately by an authoritative statement from this side that, if an invitation is received from Canada, it will certainly be accepted by the National Government.

St. Madeleine Sugar Company.—The annual Report of this Trinidad sugar factory for the year ended last June states that the crop amounted to 34,334 tons of sugar which was a record for the Company in a record Trinidad crop of 98,573 tons. Unfortunately the sugar fetched on an average no more than £10. 5s. 11d., the lowest in their history. The profit on the year was £13, 318, the expenditure being £354,024 and the revenue £367,342. After providing for the deficit from the previous year and for income tax, there remained a credit balance of £2,514, which was carried forward. The crop data include the following (the previous year in brackets): Sucrose in cane, 12·61 (12·78); Purity of Juice, 81·21 (83·72); Mill Extraction Sucrose, 96·04 (94·96); Total Recovery of Sucrose, 86·30 (86·42); Yield of Sugar 96 Pol., 8·81 (8·69).

Activated Carbons.—A German publication, reporting on progress made in the beet sugar industry, discusses the use of activated carbons. Animal charcoal, it says, is gradually being deposed by the more powerful decolorizing medium, which in application is more elastic, and requires a compacter and cheaper plant. Each campaign in different countries a greater number of factories is found to be working the new method of decolorizing, while a number of refineries are operating it in conjunction with bonechar, some having indeed abandoned the latter medium altogether. New carbons which lately have appeared, and are claimed to have a high efficiency are: "Activit," "Carbomel," "Hiagenit" and "Maxmine."

Drysdale "Thermall" Steam Engines.—The need of an improved high speed single-cylinder steam engine suitable for driving circulating pumps, dynamos, etc., that will show a good steam consumption figure, has lately received the attention of Messrs. Drysdale & Co. Ltd., of Yoker, Glasgow, and this firm have put on the market a new design, known as the Drysdale Patent "Thermall" Engine. This is of the vertical double-acting enclosed forced lubrication type, with steam and exhaust valves made separate from each other and disposed side by side at the front of the engine. A special arrangement of radial valve gear is employed, which is operated by utilizing the crank webs as eccentrics. The steam and exhaust valves being separate, the points of cut-off and compression are independent of each other, and a very good indicator diagram can thus be obtained.

"Plasmoquine."—At St. Mary's Hospital, London, Institute of Pathology and Research, nine medical students underwent the experiment of being bitten by malaria-carrying mosquitoes after taking doses of the preventive drug "Plasmoquine." In no case did malaria develop. In three control cases, using the same mosquitoes, but without administration of the drug, the disease developed within 14 days. Full details of this important investigation were recently published,[1] the conclusions drawn by those conducting it being: "This experiment, and the 15 equally successful trials which preceded it, prove that plasmoquine effectively prevents mosquito-borne malarial infection among a group of healthy individuals who take the prophylactic doses. Quinine lacks this remarkable property. The successful result in the present test was obtained by taking 0·02g. on the day before infection, and the same dose thrice daily on the day of infection and on the five following days, but, from the results of our previous tests, we know that somewhat smaller doses taken over a shorter period are equally effective."

---

[1] S. P. James, M.D., F.R.S., W. D. Nichol, M.B., D.P.M., and P. G. Shute (Malaria Laboratory, Ministry of Health, London), in the *Lancet*, 1931, No. 5638, ccxxi, 341-342.

Review of Current Technical Literature.[1]

By-Product Utilization (Production of various Chemicals from Molasses). E. P. **Hedley.** *Proceedings Fifth Congress, South African Sugar Technologists' Association.*

"In molasses we have an exceedingly cheap and abundant source of raw material from which many very valuable chemicals can be prepared. There is no reason why we should not prepare these products here, and so benefit by our own raw materials. The products of South Africa in other fields are meeting and conquering the competition from other countries on the English market. Such being the case, it should be possible to put on the home market successfully the much more valuable products resulting from our exceedingly cheap raw material—molasses. As an example of one series of products, consider the following : Starting with molasses at 85° Brix, we can get alcohol, acetic acid, calcium acetate, sodium acetate, and from the calcium acetate, acetone."

Then the author describes how his scheme would be carried out : 660 lbs. of molasses would give 175 lbs. of alcohol, which would be sold as such, or converted by fermentation to acetic acid to give 182·6 lbs. This dilute acetic acid could be concentrated and sold as such, or converted to its sodium or calcium salts, yielding 414 and 256·6 lbs. of these respectively. Acetone would be obtained from the calcium acetate by dry distillation, giving a 70 per cent. yield, viz., 56 lbs. Lastly, the acetone would be used for the production of iso-propyl alcohol. Or in place of the alcoholic fermentation of the molasses, citric and lactic acids would be fermented from it. He then continues : "There is no doubt that this scheme of producing these compounds is the cheapest. Fermentation processes beat others in first cost, and consequently in that of the final product. All these processes are well established, and in practical commercial production. This whole question is worthy, as I have said, of thorough investigation. I have heard it said that we are sugar makers, and not chemical manufacturers ; but to-day in the face of fierce world competition, such an attitude is wrong and hurtful to the industry. Other industries have found salvation in exploiting their whole resources in every economical way possible. It is absolutely necessary to cease to look on the laboratory as a mere control station ; it should be looked upon as the source of advance. Particularly in hard times people turn to their laboratories for help, and this lesson South Africa has got to learn or go under."

***Similar schemes have of late been proposed by other writers, and there are of course good reasons why financiers hesitate to take advantage of them. One is that their promoters would be entering into a highly competitive and highly organized market. Most of these chemicals (already produced by very economical methods) are now ring-controlled, and new-comers would be sternly opposed. But the main reason is that at present there is no likelihood of shortage of any of these chemicals in any country. Present sources of supply could anyway be easily increased at little capital cost to meet any greater demand, when with returning prosperity it exists. Such a project as is above proposed, besides demanding considerable experience on both the technical and the financial sides, would involve a great outlay of capital, and must be regarded as a highly speculative proposal. It is further open to some criticism technically. A more promising possibility of by-product utilization is for the production of plastics, using either molasses or bagasse, or both, as mentioned on page 539 in this issue.—Ed., *I.S.J.*

Alcohol Motor Fuels. Harry Ives Shoemaker. *Sugar News*, **1931, 12, No. 7, 417-419.**

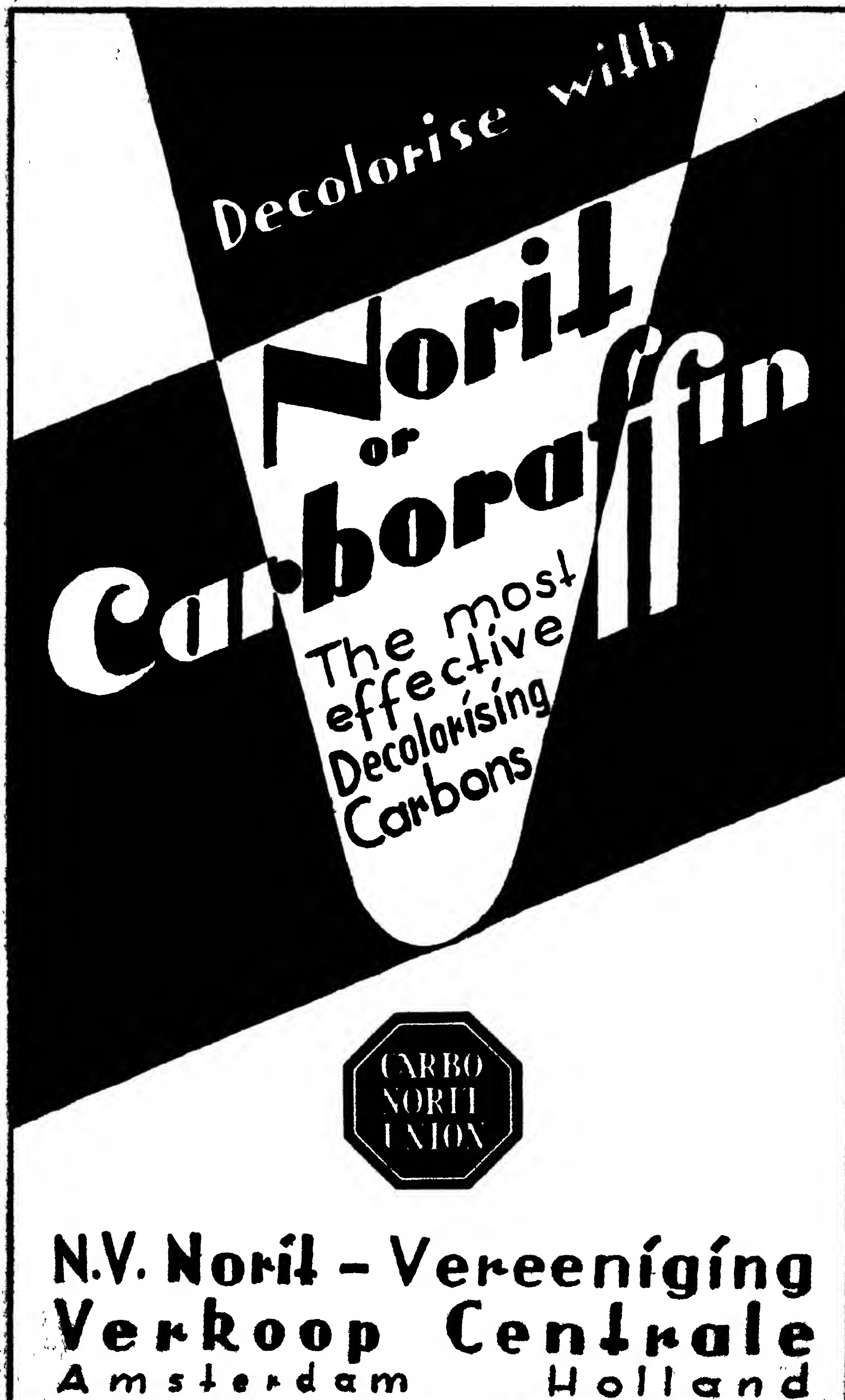
That the gasoline of commerce is not the ideal carburant for automotive engines has been recognised for a long time, but the writer has found that a mixture of 95 per cent. of alcohol with gasoline and a small percentage of a solvent which overcomes the tendency of the mixture to separate at low temperatures, more closely approaches the ideal. It gives in nearly all cases better mileage than gasoline ; works with the smoothness and freedom from knocking that characterize alcohol fuels in general ; and

minimizes carbonaceous deposits in the motor. Furthermore, it can be used interchangeably with gasoline without changes in carburettor and air adjustments, and can be produced under the proper conditions more cheaply than gasoline. The increased mileage obtained over that from gasoline seems at first anomalous in view of the lower calorific number of the mixture, but can probably be explained by the theory that the greater proportion of hydrogen in the alcohol, together with its oxygen, promotes more complete and efficient combustion of the excess of carbon in the gasoline. This theory is supported by the almost complete absence of smoke and monoxide fumes observed when using this fuel, and by practically no carbonaceous deposits in the cylinders or around the valves and piston rings. A good deal of experimental work was done before the optimum proportions were obtained, but now the fuel has been tested in regular service for several months in comparison with gasoline and other motor fuels. *It is a better fuel than gasoline and can be sold (in the Philippines) for considerably less than the prevailing retail prices of the latter fuel.* Then the author continues his statement as follows :—

It is a stock argument of those who are interested in discouraging the use of alcohol motor fuels that the combustion products therefrom are acid and cause pitting and corrosion. The most effective answer to that line of argument lies in the experience of those who have been using motor alcohols for a period of years and are competent to observe and record results. The writer has personal knowledge of automobiles and trucks that have been operated on motor alcohol for from 5 to 8 years. In none of these has any corrosion of valves, valve-seats, cylinder walls or pistons taken place. There has been the normal wear of valves and seats, necessitating periodic dressing, and very infrequent renewal of valves; also it has been necessary to renew piston rings at the same intervals as demanded by any other fuel, but cylinders have never been rebored. In the earlier experiments with alcohol as a motor fuel in the Philippines, attempts were made to use a crude alcohol of comparatively low strength (containing not above 90 per cent. by volume). Such a fuel would naturally leave acid combustion products which would (and did) damage the motors in which it was used. With the alcohol-gasoline mixture there is certainly nothing to fear, since combustion is so complete. No owner of motor cars or trucks need feel the slightest misgiving as to the effect of the new type of fuel on the internal parts of the motor. The solution of the problem of the utilization of waste molasses is at hand in the development of the new alcohol-gasoline motor spirit. It is estimated that the waste molasses produced in the Philippines could produce alcohol sufficient to supply about 20 per cent. of motor spirit requirements if made up into the "50-50" type of mixture; that is, the alcohol produced would only displace about 10 per cent. of the gasoline which would be imported otherwise. If this development takes place, the centrals and planters will have a dependable source of income from their molasses, in addition to having the problem of its disposal solved permanently. Also, the general public will have a better motor spirit at less cost, and a portion of the country's fuel bill will stay at home instead of leaving the Islands. Another motor spirit could be made using a smaller percentage of alcohol—say 10 to 20 parts, to 80 or 90 parts of gasoline, as has been done in France for a number of years, but there is some question in the writer's mind whether such a mixture would prove as efficient and satisfactory as the half-and-half composition. Only further experiments will settle that point.

REPORT OF COMMITTEE ON CLARIFICATION. **W. T. Latham.** *Proceedings Fifth Congress, South African Sugar Technologists Association.* 1931, 109.

Conditions during the year were very good on the whole, and there appears to be a continued improvement in general working. Raw juice leaving the mills is now in most cases double screened, first by the ordinary scraper cush-cush strainer, and thereafter by Peck, Mitchell or "Universal" vibrating screens, which latter two types are coming into more general use. They are found very advantageous by eliminating early in the process larger amounts of solids, which are thus prevented from dissolving (especially the waxes). It is becoming general practice to heat the screened juice to 140°F. (60°C.), adding about 90 per cent. of the lime, sulphiting


Decolorise with
Norit
or
Carboraffin
The most
effective
Decolorising
Carbons
CARBO
NORIT
UNION
N.V. Norit – Vereeniging
Verkoop Centrale
Amsterdam Holland

to at least 3 grms. SO_2 per litre, running into correcting tanks with stirrers, liming to about 8·7 *pH*, adding phosphoric acid to bring the reaction to 7·4 – 7·6 *pH*, pumping through juice-heaters to bring the temperature to 212°F., and lastly sending to the subsiders. Muds from the subsiders are heavily diluted and subsided again, being then filtered, almost always by plate presses, the filtrate going to the hot raw juice. Filter-press capacity averages 76·3 sq. ft. per ton cane hour, that is on the small side ; it should be not less than 100 sq. ft., the Committee consider, and some factories even suggest 120 when dealing with refractory juices.

Syrups do not appear to be treated in any way, except by settling, the syrup bottoms being returned to the juice for further treatment. Molasses and wash in nearly every case are heated or blown up and simmered, especially where factory white sugar is made. Following are average *pH* values for the factories reporting :—

Tempered juice	7·5	Syrup	7·0
Filtered Juice	8·4	Molasses................	6·7
Clarified Juice	7·7		

Regarding the quantities of chemicals used per ton of sugar, these are : Lime, 73·5 ; phosphoric acid (40 per cent. of P_2O_5), 11·24 ; and sulphur, 28·5 lbs. These chemicals have been increased during the last few years in order to secure a more complete clarification, and meet with the requirement of the Pure Foods Act. Treacle sugars are generally worked off by mixing with the first massecuite in raw sugar factories,but are also melted and returned to the syrup tanks. It is possible with careful clarification and centrifuging to produce a treacle sugar which will conform to the Pure Foods Act's requirements. Some of the factories are trying new metals for the tubes, and the use of stainless steel for pump rods is growing. A new type of settling tank (patented) has been tried out at Mount Edgecombe, and found to give excellent results on first carbonatation juice. It should do well in sulphitation factories. Members of the Committee on Clarification are : W. Foster, P. Murray, E. Camden-Smith, M. Viger, J. W. Wickes, and J. Rault (Convener).

PRIME MOVERS FOR SUGAR CENTRALS. **F. Valencia.** *Sugar News*, 1931, **12**, No. 9, 637-638.

Mill engines.—There is, says the writer, another type of engine which in some respects is preferable to the Corliss, namely the Stumpf uniflow, in which cylinder condensation is greatly reduced. It has central exhaust ports which are uncovered by the piston near the end of its stroke. The piston is made of unusual length ; steam enters the cylinder through poppet valves ; and, after expansion, exhausts through the central ports. In this one direction flow of steam the cylinder walls and the clearance surfaces are not cooled by the back flow of exhaust steam as in the ordinary engine. *Power factors.*—The power factors of most electric plants of sugar centrals are very low, thus lowering the capacity of the electric generating units exciters, distribution lines and transformers, on account of increased losses. This can be corrected by the use of static condensers or synchronous motors, which latter may be used in the condensing water pump drives and the vacuum pumps, where the loads of these pumps are almost constant, and the starting load very low. *Pumps.*—Multi-stage centrifugal pumps driven by electric motors or steam turbines seem to be ideal for boiler feed. requiring so little attention, but for massecuite the piston pump is holding its own. For extracting condensate and syrup from evaporators the ordinary centrifugal pump gives trouble unless the condensate flows to the pump by gravity. But there is now on the market a centrifugal pump which gives no such trouble, due to the fact that air-leakage at the glands is avoided. It consists of two single-sided impellers working in parallel, placed with the inlets facing each other, one on each side of the suction of the chamber which is in direct connexion with the pump suction in such a way that the stuffing box is on the discharge side of the pump. It draws liquid against high vacuum.

Generating unit.—Up to 500 K.W. a.c. turbo-generator units, the geared turbine of the re-entry type seems to be preferable, on account of its simple construction, and besides it is very much cheaper in price, and maintenance cost. The rotor consists of a single disc carrying one row of impulse buckets. There are no stationary buckets, only nozzles and reversing chambers, whereas the multi-stage type with so many

rows of stationary and rotor buckets with small clearances sometimes give serious trouble when a big quantity of sugar gets into the steam, as happened in one of the centrals some years ago.

Centrifugal drives.—Individual electric motor drive for centrifugals gives very satisfactory results. First it gives larger output per centrifugal, because it has fewer parts to get out of adjustment, and avoids the troublesome belting and adjustment of the clutch. Second, it makes uniform quality product because the speed is constant. In belt drives the speed decreases when the belt becomes slack and the clutch becomes a little loose. Third, less skill is required in operating as it is automatic in operation. The author has operated a set of four 48 in. × 24 in. self-discharging individual electric motor drive centrifugals for three crops now and found them very satisfactory.

SOLID CARBON DIOXIDE ("DRY- ICE") FROM BY-PRODUCT FERMENTATION GASES. **C. L. Jones.** *Industrial and Engineering Chemistry*, 1931, **23**, No. 7, 798-800. An outline with illustrations is given of the method of making "Dry-Ice" from the gases produced in the fermentation of starches in solvent manufacture, operations consisting of scrubbing the gases, compressing, and cutting the product into blocks, which are bagged by hand, and either loaded into special cars, or placed in a storage structure. The importance of adequate marketing methods is emphasized. —USE OF MOLASSES AS FERTILIZER. **Anon.** *The South African Sugar Journal*, 1931, **15**, No. 8, 521-523. Molasses contains about 60 per cent. of the potash and about 50 per cent. of the nitrogen originally present in the cane. Natal Estates, Ltd., who use it largely on their fields, mix it with their carbonatation scum cakes in a large rotary drum, afterwards adding sufficient ashes and fine bagasse to form a rather solid compound. This is used to cover the bottom of the plant holes with a layer some inches thick, which when perfectly sun-dried is covered with earth. Molasses applied in this way has given marked results in large scale estate experiments during three consecutive years. Even when applied in a diluted form the results were very encouraging. In the case of a full sized factory of 150,000 tons of cane per annum there would be available say 3375 tons of molasses, quite sufficient for manuring an annual acreage of plant cane of 1200 to 1500 acres.—NEW INDICATOR FOR CHLORIDE TITRATIONS. *Communicated to this Journal by the Eastman Kodak Company.*—Dichlorofluoresein is a very suitable indicator for the argentometric titration of chlorides in weakly acid as well as very dilute solutions; those containing as little as 15 to 20 mgrms. of chloride in a litre can be titrated with an accuracy of 1 to 2 per cent. In preparing the indicator, 0·1 grm. of it is dissolved in 50 c.c. of alcohol, 2·5 c.c. of 0·2 *N* sodium hydroxide added, and the volume made up to 100 c.c. At the end-point the silver chloride suddenly turns dark red.—EVAPORATORS. **Theodore O. Nickelsen.** *Sugar News*, 1931, **12**, No. 9, 641. In a review entitled "Factory Engineering," it is said that cleaning of evaporators can be made automatic for a limited time by increased circulation, which can be provided for by several means, e.g. (1) providing a free outlet for the vapours passing from effect to effect and to the condensers; and (2) prevention of water-logging of the calandria (*a*) by natural flow, (*b*) by pumps or by difference in barometric pressures, i.e. higher vacuums, (*c*) ample-size outlets for condensed waters and long-radius bends for all purposes. Circulation of the liquid being evaporated again may be improved by accelerating the flow of vapours by the use of ejectors or other mechanical means.—ANALYSIS OF CANE JUICE FOR P_2O_5 AND K_2O. **Carlos L. Locsin.** *Sugar News*, 1931, **12**, No. 9, 620-621. Figures collected since 1923 shows that there exists a certain amount of correlation between the lack of available phosphate and potash in the soil and the percentage of these constituents found in the cane juice. In dealing with different varieties of cane, the standards proposed by WALKER[1] require further study. Different varieties have different feeding habits. One approximate standard for each variety in general use may easily be established, and would be a very useful guide in fertilizer practice, where field experiments and soil analyses are not easily available.

J. P. O.

1 *I.S.J.*, 1923, 214, 478.

Review of Recent Patents.[1]

UNITED STATES.

Bonechar Dryer. **James Hamill and John F. Taddiken**, of New York. 1,784,626. December 9th, 1930.

During the drying of the char in the dryer, which is connected to, but separate from, the char kiln, the vapours of evaporation are withdrawn at different points of the drying char, and such vapours are permitted to escape to the stack or chimney without passing them through other and cooler portions of the drying char where they would be condensed. This materially assists the drying of the wet char and speeds up the process of revivifying it, thereby reducing the cost. Also preferably, though not necessarily, another medium, such as external dry air, is passed through the body of drying char so that this air, or other similar medium, passing through the drying char will carry off the vapours of evaporation and further assist in removing such vapours to the chimney or stack without permitting them to pass through the cooler portions of the drying char where such vapours would be condensed. The passage of this external air, or other medium, is controlled in any suitable way to give the desired rate of flow; the rate of flow is sufficient to most expeditiously remove from the body of the drying char the vapours of evaporation and permit them to pass independently to the stack. Ordinarily, the draught of the stack will be sufficient, though if desired a forced draught may be employed.

Claims are : (1) A predryer for a char revivifying apparatus including in combination a chamber, means for feeding char downwardly there-through, a plurality of spaced-apart heating flues adapted to divide the downwardly travelling char into a plurality of thin streams, fins extending from said heating flues to define passages for air currents, and means for passing external air through the chamber in intimate contact with the char for the purpose of removing the evaporated moisture and gaseous impurities. (2) A predryer for a char revivifying apparatus including in combination a chamber, a chimney communicating with the heating means at the rear of the chamber, air channels between the levels of heating means communicating with the chimney, means at the front of the chamber for admitting atmospheric air into each channel whereby currents of fresh air pass through the chamber in direct contact with the char at each level to carry away the vapours and prevent their movement to different levels and additional air openings along the sides of the chamber communicating with said air channels.

Cane Disintegrators. **William H. Morgan** (assignor to the **Morgan Hurrycane Company**, of New York). (*A*) 1,804,267. May 5th, 1931. (*B*) 1,804,797. May 12th, 1931. (*C*) 1,813,070. July 7th, 1931.

(*A*) This is an improvement on previously described apparatus.[2] Cane, preferably cut into short sections about 6 in. in length is subjected to the action of disintegrating blades or cutters which cut or split the stalks repeatedly longitudinally or in the general directions of the axes of the stalks to reduce the same to a disintegrated fibrous mass containing relatively long fibres of the cane. The longitudinal splitting or cutting of the cane is highly important, in that the longitudinal fibres are preserved in the disintegrating operation, and is to be distinguished from disintegration proper by cutting the cane transversely, which destroys the long fibres and converts the cane into a pulpy mass. (*B*) This disintegrator combines two stationary discs, shearing knives mounted on the inner faces of said discs, a hopper formed between the upper portions of said discs, the said discs being provided with openings communicating with the hopper adjacent the centres of the discs, the bottom of the hopper being cone-shaped and extending below said openings, a rotary shaft passing through said discs, and non-adjustable discs secured to said shaft and provided on their inner faces with shearing knives which co-act with the knives on the stationary

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom* : Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced with the permission of the Controller of H.M. Stationery Office, London, from the Group Abridgements issued by this Department. Sometimes only the drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany* : Patentamt, Berlin, Germany.

[2] U.S. Patent Re-issue, 17,518; *I.S.J.*, 1930, 109.

discs. (*C*) This apparatus for reducing cane to a fibrous mass comprises a fixed hollow frame or housing having shearing means on the inner faces of its sides and extending approximately from the centre of the housing toward the periphery thereof, a shaft mounted to rotate in said housing, a disc fixed to said shaft and having shearing means projecting outwardly on its two side faces approximately from its hub to its periphery, each of the two shearing chambers formed by the housing and disc being approximately the same size and shape, the said shearing means on the housing and disc co-operating to break the material fed to the interior of the housing into a fibrous or excelsior-like mass, and a hopper common to both shearing chambers, whereby the material will be fed simultaneously to both sides of the disc-like member substantially as and for the purpose set forth.

EXTRACTION OF CELLULOSE FROM BAGASSE. **Raymond C. McQuiston and Harry von Loesecke** (assignors to the **United Fruit Co.**, of Boston, Mass.). 1,813,184. July 7th, 1931. Claim is made for the method of extracting cellulose from bagasse consisting in treating it with a solution of sodium hydroxide in sea-water.—CLARIFICATION PROCESS. **Charles Schwieger,** of San Francisco, Cal. 1,815,276. July 21st, 1931. In the process of manufacturing sugar, the step of treating sugar juice with ammonium carbonate in addition to the carbonatation process.—WASHING SUGAR CRYSTALS. **Julian Bergé** (assignor to **Raffinerie Tirlemontoise,** Belgium). 1,811,169. June 23rd, 1931. The invention consists in a process for removing the colour, so that loss of crystals is avoided. Crystals, freed as far as possible from the adhering mother-liquor by centrifugal action, for instance by the use of washing liquid in the centrifuge or a particularly high centrifugal force such as disclosed in a co-pending application,[1] but not quite colourless, are mashed with a saturated or approximately saturated pure white sugar solution. The colouring matter of the crystal pass completely or almost completely according to the duration of the mashing process into solution without the crystal, being attacked. At the end of the mashing process the sugar solution is separated from the crystal in any suitable manner, for example by centrifugal action. The colour taken up by the sugar solution can be removed by filtering through animal charcoal, decolorizing carbon or the like, and can again be used for mashing the crystals. If the dyes are not sufficiently removed from the crystals by a single mashing, this can be repeated with a fresh sugar solution.—DISTILLATION AND DEHYDRATION OF ALCOHOL. **Eloi Ricard, Paul Savarit and Henri M. Guinot,** of Melle, France (assignors to the **U.S. Industrial Alcohol Co.,** of New York). 1,822,454; 1,822,455. September 8th, 1931. A continuous process for the manufacture of absolute alcohol from dilute alcohol, which comprises distilling the dilute alcohol in one apparatus and dehydrating the alcohol thus obtained in another apparatus and heating the dehydration apparatus by circulating alcoholic vapours from the first distilling apparatus so that they condense in indirect heat-exchange relation with the contents of the dehydrating apparatus and return to the first distilling apparatus.

UNITED KINGDOM.

MANUFACTURE OF CARAMEL. **F. Albrecht.** 346,136. March 19th, 1930. Solid sugar is mixed and liquefied with an aqueous solution of ammonia of the order of 25 per cent., the mixture is heated for a time to a temperature of 105-120°C. under pressure, the pressure is released, and the viscid product is then again heated under pressure to a temperature of 105-120°C. for such time as is necessary to reach the desired degree of colour, after which the pressure is reduced.—ENTRAINMENT PREVENTION IN EVAPORATORS. **G. & J. Weir, Ltd.,** and **J. G. Weir,** of Cathcart, Glasgow. 345,810. March 21st, 1930. A perforated plate extends across the steam space not far beneath a baffle which is provided with a central port formed with an outwardly arranged gutter carrying a drain-pipe for returning collected liquid.—REGENERATION OF KIESELGUHR. **C. F. Armstrong,** 9, Northumberland Ave., London. 346,472. January 18th, 1930. To restore the filtering properties of kieselguhr, which has been used, for example, in the treatment of sugar liquors, it is agitated

[1] Serial No. 167,598, filed concurrently herewith which has resulted in Patent No. 1,775,385.

in a boiling solution of hydrochloric or other mineral acid, the mixture being then separated in a filter and the cake formed washed with hot water and dried by means of steam while still in the filter. In a modified process, the acid is separated from the kieselguhr by decantation, the kieselguhr being passed with wash-water into the filter.—CRYSTALLIZER.[1] **W. G. Hall,** of 6th Avenue, Honolulu, T.H. 348,950. July 8th, 1930; convention date July 31st, 1929. Massecuite is cooled in a tank fitted with two stirrers, one of which is wholly submerged, whilst the other is partially immersed in and operates to pick up portions of the massecuite and allow it to fall through the air. The stirrers are helical strips, carried by arms on parallel shafts, geared together.—EXTRACTION OF SUCROSE FROM CANE MOLASSES. **International Industrial & Chemical Co. Ltd.,** and **S. Wittouck,** of Montreal, Canada. 347,217. January 21st, 1930. After being diluted, the cane molasses is treated with baryta for the destruction of reducing sugars, heated, and filtered, the cake being washed with water, and the wash-waters used for diluting a further quantity of molasses. Barium hydrate in the proportion of about 2 molecules to one of sucrose is added to the solution to precipitate barium saccharate. This is filtered, and carbonatated to produce a solution of sucrose and insoluble barium carbonate, which is separated. All traces of barium are eliminated from the solution of sucrose by adding a small quantity of alkaline salt, as sulphate or carbonate.—CLARIFICATION, USING ACTIVATED CHARCOAL. **Maxime Soc. Anon.,** of Verviers, Belgium. 348,758. February 25th, 1930. Solutions containing colloidal impurities, particularly raw and intermediate products in the sugar industry are purified and decolorized by the use of a colloidal active charcoal in the state of a "sol," as a paste, having a water content of 80-90 per cent. Its preparation is described. FERTILIZER MANUFACTURE FROM MOLASSES, ETC. (SPRAY EVAPORATORS). **I. Dubinbaum and L. R. Christie,** of Pittsburg, U.S.A. 349,178. March 11th, 1930. Beet molasses, distillery slops, etc., are mixed with sulphuric acid, and also if required with other fertilizing substances, and atomized in a current of heated air, so as to dry the mixture into solid particles. (A description is given of the plant recommended.)—CLARIFICATION PROCESS, INVOLVING CENTRIFUGING. **S. Cole,** of 18, Essex St., Strand, London. 350,118. April 4th, 1930. Sugar juices or syrups obtained by diffusion are treated with a diluted acid in amount sufficient to ensure the coagulation of the non-sugars and albuminoids and the acidified juices are submitted to a centrifugal action. An alkaline substance is then added to render the juice faintly alkaline and the juice is again centrifuged. An example is given of the treatment of raw juice or syrup with diluted sulphuric acid to impart a *pH* value of 4·3 to 4·5 and a treatment after centrifuging with an amount of lime and soda to produce a *pH* value of 7·4 to 7·6 and again centrifuging.—CLARIFICATION PROCESS WITH RETURN OF CARBONATATED JUICES. **Dorr Co.** of 247, Park Ave., New York. 350,459. December 4th, 1929; convention date, December 4th, 1928. Sugar juices are purified by mixing them with partially or wholly carbonatated juices prior to carbonatation. A portion of the carbonatated juice may be continually re-circulated and mixed with the raw juice in the apparatus described in Specification 349,632. Specification 270,757 is referred to.—CLARIFICATION PROCESS USING LIME AND LIQUID SULPHUR DIOXIDE. **D. Teatini,** of Hougaerde, Belgium. 351,160. May 1st, 1931; convention date, February 15th, 1931. Sugar factory and refinery juices are purified by adding lime to the juice at the known optimum temperature in amount sufficient to make the juice alkaline to an extent in excess of the alkalinity corresponding with the *pH* value which characterizes the isoelectric point of the colloids in the juice and then introducing sulphur dioxide preferably in the liquid state, or its equivalent, in amount sufficient to bring the alkalinity to that connoting the said zone. The flocks formed may be separated at this point by filtration. A small addition of lime is then made for subsequent carbonatation. The first addition of lime may be made by adding juice which has already been subjected to the process and subsequently treated with lime. The addition may be made in the course of the diffusion process, i.e. in the last vessel of the diffusion battery.

[1] See U.S. Patent, 1,769,799. *I.S.J.*, 1931, 90.

United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

	One Month ending September 30th.		Nine Months ending September 30th.	
	1930. Tons.	1931. Tons.	1930. Tons.	1931. Tons.
Unrefined Sugars.				
Poland	....	9,052	41,878	127,073
Germany	438	6,671	45,552	133,915
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	....	....	607	555
Java	....	....	2	....
Philippine Islands	....	....	....	....
Cuba	73,906	55,394	663,998	413,486
Dutch Guiana	....	....	....	....
Hayti and San Domingo	6,845	....	203,891	99,790
Mexico	....	....	....	....
Peru	16,692	16,924	67,398	105,889
Brazil	6,853	818	62,666	5,426
Union of South Africa	12,554	17,594	43,377	86,544
Mauritius	125	111	79,574	123,340
Australia	7,432	12,672	77,299	105,462
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	774	143	72,462	53,789
Other Countries	3,449	1,120	37,617	64,445
Total Raw Sugars	**129,067**	**120,500**	**1,396,322**	**1,319,713**
Refined Sugars.				
Poland	....	....	491	327
Germany	10	50	753	718
Netherlands	1,152	647	12,028	6,976
Belgium	106	126	770	1,144
France	....	....	....	....
Czecho-Slovakia	1,275	3,168	23,505	27,615
Java	....	....	....	....
United States of America	334	1,009	7,420	6,973
Canada	....	1	5	5
Other Countries	1	1	30	48
Total Refined Sugars	**2,877**	**5,002**	**45,003**	**43,806**
Molasses — Foreign	19,529	2,314	209,415	86,008
Molasses — British	7,433	229	24,351	44,255
Total Imports	**158,906**	**128,045**	**1,675,091**	**1,493,782**

EXPORTS.

	Tons.	Tons.	Tons.	Tons.
British Refined Sugars.				
Denmark	26	25	435	362
Netherlands	....	....	....	....
Irish Free State	3,945	3,182	31,915	27,993
Channel Islands	115	84	1,314	838
British West Africa	188	124	1,480	1,384
Canada	....	....	....	....
Other Countries	40,908	2,852	201,704	43,420
	45,183	6,268	236,848	73,998
Foreign & Colonial Sugars.				
Refined and Candy	301	148	2,677	1,903
Unrefined	37	17	425	332
Various Mixed in Bond	....	....	....	....
Molasses	36	10	609	105
Total Exports	**45,557**	**6,443**	**240,559**	**76,338**

United States Atlantic Ports.

(Willett & Gray).

(Total of 2,240 lbs.)	1931 Tons.		1930 Tons.
Total Receipts, Jan. 1st to Oct. 17th	2,065,487	..	2,032,756
Deliveries " " "	2,119,772	..	2,34[illegible],622
Meltings by Refiners " "	2,110,128	..	2,398,060
Exports of Refined " "	37,500	..	40,000
Importers' Stocks, October 17th	104,607	..	126,405
Total Stocks, " "	200,027	..	231,561
	1930		1929
Total Consumption for twelve months	5,599,377	..	5,810,980

Cuba.

RECEIPTS, EXPORTS AND STOCK AT OCTOBER 17TH.

(Willett & Gray).

	1931 Tons.		1930 Tons.
Production to date	3,122,186	..	4,671,260
Less Cuban Consumption to date	119,000	..	122,000
	3,003,186	..	4,549,260
Stock at Shipping Ports	681,681	..	1,038,255
Total Exports	1,213,296	..	2,295,139
Total Receipts at Shipping Ports	1,894,977	..	3,333,394
Stock on Plantations and in transit to Ports	1,108,209	..	1,215,866
Total Sugar in Cuba (partly estimated)	2,187,671	..	2,254,121

United Kingdom.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION OF FOREIGN SUGAR FOR NINE MONTHS ENDING SEPTEMBER 30TH, 1929, 1930, AND 1931.

IMPORTS.	1929. Tons.	1930. Tons.	1931. Tons.
Refined ..	42,743 ..	45,003 ..	43,806
Raw	1,603,343 ..	1,396,322 ..	1,319,713
Molasses...	175,916 ..	233,766 ..	130,263
	1,822,002	1,675,091	1,493,782

EXPORTS (Foreign).	1929. Tons.		1930. Tons.		1931. Tons.
Refined	1,785	..	2,677	..	1,903
Raw	583	..	425	..	332
Molasses	8,325	..	609	..	105
	10,693		3,711		2,340

HOME CONSUMPTION OF IMPORTED SUGAR.

	1929. Tons.		1930. Tons.		1931. Tons.
Refined	43,304	..	43,256	..	42,981
*Refined (in Bond) in the United Kingdom	1,888	..	1,157	..	18
†Raw	1,541,594	..	1,556,460	..	1,452,320
Total of Sugar	1,586,786	..	1,600,873	..	1,495,319
Molasses	7,072	..	5,487	..	4,228
Molasses, manufactured (in Bond) in the United Kingdom..	2	..	6	..	—
	1,593,860		1,606,366		1,499,547

STOCKS IN BOND IN THE CUSTOMS WAREHOUSES OR ENTERED TO BE WAREHOUSED AT SEPTEMBER 30TH.

	1929. Tons.		1930. Tons.		1931. Tons.
Manufactured from Home Grown Beet	3,900	..	2,050	..	1,300
Refined in Bond	5,250	..	250	..	200
Foreign Refined	8,600	..	6,850	..	3,800
" Unrefined	229,350	..	176,700	..	136,350
	247,100		185,850		141,650

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty-paid sugar returned to refineries to be again refined. Sugar refineries ceased working in Bond as from 25th April, 1928.

† The quantities here shown include 1,378,709 tons entered for refining in refineries in the nine months ended September 30th, 1931.

Sugar Market Report.

Our last report was dated 9th October, 1931.

The prevailing factor in regulating the price on the London Terminal Market during the past month has been the value of the pound sterling. This further depreciated and at the time of writing is quoted on a basis of $3·75, a fall of 15 points over the month. This represents about 3d. per cwt. increase in cost, calculated in English currency. Prices, however, showed a fall of about 3d. per cwt. on the London Terminal Market, as compared with a month ago, which can be taken as intrinsically representing a drop of about 6d. per cwt. during the period under review.

This is generally attributed to a continuance of hedge selling by Continental producers, who find that owing to international depression, and for other reasons, they have sold very little of their sugar in advance, and feel somewhat uneasy that a larger proportion of their production is on their hands at this period of the campaign than in normal times. The latest prices are, December 6s. 5¼d., March 6s. 8¼d., May 6s. 10½d. and August at 7s. 0½d.

There does not appear to be any evidence of confidence having returned and the trade demand which in some quarters was looked for as a result of the establishment of a strong National Government in England has so far not materialized.

The British Refiners reduced their prices by 6d. per cwt. on the 2nd instant, and their standard marks at the present time are as follows : No. 1 Cubes 23s. 9d., London Granulated 20s. 1½d.

Business in actual raws has again been small, and only a few parcels, principally Perus and Cubans have been sold at about 6s. 6d. Continental 88 per cent. has been dealt in at 5s. 9d. to 6s. 1½d. f.o.b. Danzig.

F. O. Licht issued, on the 2nd instant, a further estimate of the European crop, showing Europe, excluding Russia, at 6,220,000 tons, and Russia 2,150,000 tons. This shows an increase of about 49,000 tons on his estimate for countries other than Russia.

21, Mincing Lane,
London, E.C.3.
6th November, 1931.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 396. DECEMBER, 1931. Vol. XXXIII.

Notes and Comments.

The Outlook.

It is becoming clear that the first effects of the working of the Chadbourne agreement are confined to preventing the sugar market from going from bad to worse. The improvement in the market which the recent statistical position would, in more normal times, have brought along before now has been neutralized by the general unhealthiness of world international trade. Sugar is only one of many staple commodities that are suffering from world stagnation—everywhere the wheels of international trade seem more or less clogged. Sugar is less affected than some of them and will the more quickly recover when the turning point is reached. But even sugar consumption has slacked off of late and we observe that F. O. Licht premises a 5 per cent. reduction in 1932 as compared with 1931. This slackening of consumption—in the East due to the disturbed state of China where internal strife, flood and famine have played havoc with that country, and in the United States due probably to the comparative poverty of the individual households as a result of the losses in speculation and the subsequently straightened circumstances of industrial employment—will result in Java and Cuba, the two biggest producers, being unable to get rid of their allowed quotas by the end of 1931. Cuba is expected to have nearly half a million tons of her American quota unsold and as this under the Chadbourne agreement has to be taken off her 1932 crop, the outlook in Cuba is uncertain and is giving rise to considerable resentment. The situation is indeed so serious that it is reported that Mr. Chadbourne will recommend at the December meeting of the International Sugar Council that next year's world crops shall be reduced by the amount they have been over-produced this year. The view is that both Cuba and Java will be unduly penalized in the face of their excessive surplusses if all the parties subscribing to the agreement do not share in the deficiencies of consumption.

Java too has not been without its troubles. The V.I.S.P. has maintained a selling reserve for some time past, but has had to come down from its ideas of 8 Florins to 7 and even 6½. Certain malcontents in that Association have pressed for freer selling facilities, but any dissolution of the V.I.S.P. would make matters worse for all parties. The leading members are the Dutch

Banks who own most of the Java sugar factories, so facilities for financing a waiting policy are not lacking. But even Java realizes the desirability of straightening out the tangle and it is reported that the 1932 plantings to be reaped in 1933 will be reduced by possibly 40 per cent.

Willett & Gray came out at mid-November with their first estimate of the 1931-32 World Crops. As compared with 28,659,639 tons in 1930-31, they forecast for the coming season a total of 25,925,219 tons, or a decrease of no less than 2,734,420 tons, which figure, they remark, is the largest reduction ever indicated in the many years in which they have compiled crop estimates. Their figures are given in detail on another page. Cuba, it will be noted, is put at 3,000,000 tons. The total world cane sugar crops show a decrease of 424,000 tons, largely due to sacrifices of Cuba and Java. The only outstanding increase is that of Porto Rico, which is producing 136,000 tons more; but this increase will be largely counterbalanced by decreases in U.S. domestic production. The total world sugar crops on their part show an estimated reduction by 2,310,436 tons.

F. O. LICHT's third estimate (which may be taken as approximating to the final one) of the European beet crops shows a further reduction by 120,000 tons, and so disposes of the fear that the fine Autumn weather would make up for the cold Summer, and involve an addition to the earlier estimates. LICHT puts Russia at 2,150,000 as heretofore, but Czarnikow, basing his calculations on information in the *Pravda* of November 24th, thinks that no more than 1,900,000 tons is indicated; and it may be even less if last year's yield of 15 per cent. is not equalled.

The National Government at Work.

Once the new Parliament assembled at Westminster, the National Government lost no time in getting to work with certain preliminary measures to reduce the excess of imports and prevent the excessive dumping of foreign goods into this country in anticipation of a permanent tariff. The extent to which preliminary duties have been imposed has not gone far enough to please the "whole hoggers" amongst the tariff reformers, but neither has it pleased the free traders by the degree of protection already achieved. Parliament is to be adjourned for Christmas and will meet again early in February, after which one may look forward to the unfolding of a permanent tariff scheme. Meantime, the Government has lost no time in approaching the Dominions with its ideas of trade reciprocity, and a conference of all the States concerned will be held next summer, probably at Ottawa. The principle of a quota for wheat at home to allow home-grown wheat to be marketed is announced; but at the time of writing the Government's intentions with regard to the home beet sugar industry are not known. Probably they will be a feature of the next Budget, which is almost certain to revise the preferential scale of sugar duties in the light of more recent knowledge of Colonial requirements.

British Empire Reciprocity.

Sir EDWARD DAVSON has addressed to all the members of the new United Kingdom Parliament a letter on behalf of the British Empire Producers Organization, setting forth the economic advantages to Great Britain of Empire Trade, and demonstrating that the countries of the Empire are incomparably our best markets, both actual and potential. Figures are adduced showing that the purchases by Empire countries from Great Britain

per head of population are far greater than those by foreign customer countries. Instances of such *per caput* consumption are: New Zealand, £14. 10s. 6d.; Australia, £8. 10s. 2d.; South Africa, £4. 2s. 5d.; British Guiana, £3. 9s.; Mauritius £1. 13s.; whereas amongst foreign countries Norway, topping the list, takes £3. 9s. 11d., Germany 11s. 5d., and the U.S.A. 7s. 5d. As regards the total value of imports from us, the British Colonies and Protectorates take £462 millions, Australia 54, U.S.A. 45, Germany 37, and Union of South Africa 33 millions.

Sir EDWARD DAVSON states that the principle upon which the producers associated in the B.E.P.O. have always acted is that in all primary products capable of development in Great Britain, the Home producer should have the first right of the market, but that the Empire producer should have the next preference over the foreigner. It remains to be seen, then, whether the overseas interests of the Organization, as regards sugar, will acquiesce in the suggestions of the protagonists of the Home beet sugar industry that this latter sugar should provide the bulk of that consumed within the U.K., or whether they will advocate that overseas cane sugar mainly from the Empire is to have the lion's share. The Government will have to decide within the next six months what is to be its policy towards these somewhat conflicting claims; the permanent success of the beet industry in England necessarily hangs on the continuation of the subsidy at a certain minimum figure which can hardly be put at the present 6s. 6d.

Leeward Islands Sugar Companies' Reports.

ANTIGUA SUGAR FACTORY LTD.—The 12th Annual Report of this Company for the year ended September 30th last reports that the crop season was a disastrous one for the island. Owing to a very severe drought (the worst experienced for 65 years) the cane crop was practically a failure, the average yield of canes being under 5¼ tons per acre and the factory output only 4442 tons (as against 15,556 tons in 1930 and 19,974 tons in 1927). On the top of that, the sugar market fell further, the average price obtained being £9. 12s. 10d., as compared with £10. 1s. 6d. in 1930 and as much as £16. 6s. 3d. in 1927. Owing to the continued difficult position of many estates, the Company, as in 1930, paid for canes at the rate of 14s. per ton, whereas the contract terms would have given only 10s. 9d. per ton. In consequence of this failure of the crop, the costs of running the factory were out of all proportion to the sugar produced, with the result that the year shows a loss of £13,973. After the necessary additions and deductions there remains the sum of £16,580 to be carried forward, no dividend being available.

ST. KITTS (BASSE TERRE) SUGAR FACTORY LTD.—The annual report of this factory for the year ended last September reveals a similarly disastrous season. The island suffered from the severe drought, which reduced the year's crop of sugar to 12,021 tons, as compared with 18,680 tons in 1930. The average price obtained for the sugar was but £9. 10s. 2d., as compared with £10. 6s. 2d. in 1930 and £11. 16s. 4d. in 1929. This Company also paid for cane at the rate of 14s. per ton, as compared with the contractual rate of 12s. 4d. After paying interest on debentures there remains a surplus of £2999, most of which has been transferred to the London Company. This last, which has a reserve of revenue amounting to nearly £40,000, is paying a dividend of 5 per cent.

Canning as a New United Kingdom Industry.

The canning of home-grown foodstuffs—fruit, vegetables, meat, fish and milk—is a comparatively new industry in the United Kingdom; but is making such headway that the *Times* newspaper saw fit the other day to bring out as a supplement a British Canning Industry number, which surveyed the position and revealed the strides the young industry has made within the last year or two. The old-fashioned distrust of "tinned" foods in this country is fast disappearing and thanks to scientific research is proved to be entirely baseless. Then there has been within the last 18 months a marked advance in the design of British canning machinery which has led to a new export trade in that class of machinery. The recent excess of food imports amongst others has added to the arguments for aiding the home farming industry to produce more of the country's requirements, and the canning industry only waits for the National Government to settle its policy in the matter. If this is favourable, then the canning industry must receive a further fillip.

Sugar is an important ingredient in the filling of cans containing preserved fruits. The cans after being packed with fruit are filled up with syrup. Thus a large proportion of the weight of canned fruit and jams consists of sugar, jam containing sugar up to 45 per cent. of its weight and a can of fruit 25 per cent. The preserving of fruit in the form of jams is no new industry, of course, in the United Kingdom, but the canning of fresh fruit largely is, and it will to a considerable extent take the place of the imported variety, save in respect to fruits not normally grown in this country. To that extent then the sugar consumption stands to benefit.

This Canning Number contains an article by Mr. ALFRED WOOD advocating the co-operation of the Home beet sugar industry with the new canning venture, so as to avoid unnecessary transport charges and handling of the sugar. He states that there is no technical disadvantage in the use of beet sugar for the canning and preserving of fruit. "Experiments conducted under the auspices of the Ministry of Agriculture and Fisheries at the University of Bristol Research Station, Chipping Campden, have demonstrated the complete suitability of beet sugar for the making of jams, jellies and other preserves, and further 'have shown conclusively that beet sugar is quite as satisfactory as cane from every point of view' in the preparation of syrups for fruit canning. Moreover, further experiments have shown that beet sugar possesses an inhibitory factor not possessed by cane sugar, which tends to minimize the corrosion of cans." Mr. WOOD is of course interested in the Anglo-Dutch group of beet factories which turns out white sugars and not refining raws, and he visualizes canning factories next door, as it were, to the sugar factories.

England is not the only country, however, that is taking an interest in canning as a new form of commercial enterprise. In some of our sugar colonies, for example in Mauritius, projects to grow fruit and can it with the aid of locally produced sugar are under consideration. Hawaii with its sugar and pine-apples is probably the most outstanding example of the co-operation of sugar and fruit in one district. Providing there is a market for the canned product there seems no reason why fruit and sugar should not thrive commercially as adjacent crops. A suitable sugar for canning can be obtained economically from plantation white or even raw sugars by treatment with one or other of the activated carbons now on the market, so the absence of a refinery need not be an obstacle. But as both South Africa and Australia

are engaged in the fruit canning industry in steadily increasing degree, would-be producers in other tropical regions will need to assure themselves that there is likely to be a market for their products, or else a glut of canned foods will result and the weakest producers will necessarily go to the wall.

Tate & Lyle have a Good Year.

TATE & LYLE LTD., the British sugar refiners, had a very favourable year for the 12 months ending September 30th last. They were no longer, as in 1930, troubled with a falling market price for their raw supplies. Consequently with the largest part of the United Kingdom sugar consumption passing through their hands, their trading operations were uniformly successful, and they made a remarkable recovery from the setback of 1930. Net profits amounted to £901,481 (against £339,584), showing a return of over 24 per cent. on the ordinary capital. The dividend is increased from 10 to 13½ per cent. and about £350,000 is transferred to various reserves, which now aggregate £2,101,000, and there is a carry forward of £61,832.

At the annual meeting , the President (Sir E. W. TATE, Bart.) said that on October 1st, 1930, the raw sugar market was at about its lowest. Since then there had been a gradual upward tendency with occasional spurts which had not been maintained for any length of time ; the market as a whole had been dull and lifeless, and the average level of prices has remained low. When the £ dropped to about 16s., there was an immediate rise in price of sugar of about 1s. 6d., i.e., from 5s. 6d. to 7s. per cwt., but this rise had not been wholly maintained. Obviously raw sugar from dollar countries will cost us more ; but this country is dependent on such dollar sources only to the extent of 50 per cent. of its requirements, and it is probably due to that fact that the whole effect of the depreciation of sterling is not felt in the price of sugar in England ; part of it is borne by the dollar countries themselves.

Sir ERNEST TATE remarked that the statistical position was becoming considerably stronger ; there is the decrease in the European crops, and the reserve stocks in Cuba are disappearing. It may take some time yet, but he was convinced that there was a tendency for the price to go up all over the world. As for the Company's sales, the output from the various refineries had been practically the same as last year. Home sales had increased, but there had been a falling off in the export business. At home competition was increased by the fact that a number of the Home beet factories were importing and refining raw cane sugars in the off-season, and he considered that the refining capacity of the country was becoming greater than its requirements. A gratifying feature, however, was that an increasing proportion of raw sugar was reaching them from the home-grown beet factories.

What the future had in store for that beet industry could only be guessed, but it seemed fairly certain that further assistance would be sought from the Government. He personally could not imagine the Government asking the taxpayers of this country for further sacrifices in order to provide increased assistance or a permanent subsidy for beet sugar, unless the request came from the British sugar industry as a whole. His firm could hardly be expected to do anything but oppose with all their power any attempt to subsidize further the production of white sugar competing directly with their finished refined products. It was only on the lines of using the beet factories to turn out raws for the refineries that the British sugar industry as a whole could be united in a common policy.

The 1932 Puerto Rico Congress of the International Society of Sugar Cane Technologists.

Details of the Programme and Papers.

The Congress will be officially opened on March 2nd, 1932, by the Honorable THEODORE ROOSEVELT, Governor of Puerto Rico ; addresses will also be delivered by the President of the Association of Sugar Producers and by the Commissioner of Agriculture and Commerce of Puerto Rico. Reply will be made by the General Chairman of the Society, and the foreign delegates will also be heard on that occasion. This will be followed by three lectures on cane culture and sugar manufacture in Puerto Rico, to acquaint the delegates with the present status of the local industry. In the evening the Governor of Puerto Rico will give a reception to the Society.

Formal sessions of the Society and of its various sections will be held only during the morning hours, in order to leave the afternoons free for committee meetings, informal conferences, sight-seeing trips, etc. For the same reason social functions have been scheduled only for every second evening, so that the members may have ample opportunity to follow their personal inclinations.

The first General and Business Meeting will take place on March 3rd; at its conclusion two lectures of general interest are to be given. On the following day the Congress will divide into three Sections, to hear and discuss reports and papers on the general subjects of agronomy, insect pests and diseases, and factory operation, respectively. These sessions will be held on March 4th, 5th, 7th, and 8th. On the evening of March 4th, Dr. E. W. BRANDES will exhibit moving pictures of the New Guinea Expedition, and of Mechanical Cane Harvesting Operations in Floridà. On Sunday, March 6th, there will be an excursion to the Isabela Irrigation Works. The Association of Sugar Technologists of Puerto Rico will give a banquet on the evening of March 7th.

The concluding General and Business Meeting is scheduled for March 9th. The meeting place for the Fifth Congress will be decided on at this session, new officers will be elected, and any resolutions to be offered will be acted upon.

On Thursday, March 10th, the Society will be entertained at the Insular Experiment Station, Rio Piedras, where a luncheon will be given to the visitors.

An organized excursion to visit a number of sugar factories and estates will start on March 11th, and extend to March 15th. During this time the participants will be the guests of the Sugar Producers' Association, and all expenses will be defrayed by the latter.

Hotel Accommodation.—The Condado Hotel has been secured for headquarters. Here special low rates have been granted for the Congress. All delegates and members are requested to make their reservations as soon as possible through the Local Secretary, Mr. M. A. DEL VALLE, Central Constancia, Toa Baja, Puerto Rico. His registered cable address is : Mavalle, San Juan.

Steamship Connexions.—The large liners of the New York and Porto Rico Steamship Company leave New York every Thursday. That sailing on February 25th is the latest that will arrive in time for the Congress. There are also Cabin class ships sailing from New York on Saturdays. Those sailing from European ports can use the fortnightly service of the Royal Netherlands Steamship Co. from Amsterdam to San Juan ; or the Leyland Line fortnightly from Liverpool and Havre.

The 1932 Puerto Rico Congress of Sugar Cane Technologists.

Membership and Regional Sections.—According to advices received from the General Secretary, A. H. ROSENFELD, there has been a further increase in the paid membership of the Society which now stands at 436, distributed over 20 regional sections. This does not include the Japan Section which has been organized but whose complete roster has not been received as yet.

Reports of Committees and Papers to be Presented at the Congress.—In October, 1929, all the Chairmen of Technical Committees were notified of their appointment, being requested to submit at the San Juan Congress a report on the activities of their committee and to prepare a programme of papers to be presented and discussed. On October 15th of this year they were asked to send in a brief report on the results achieved by them so far, and a list of the papers to be offered by members of their committee or by other interested technologists. The response has been very gratifying, and a summary of the replies is given herewith :—

Committee on Protective Sugar Cane Quarantine.—W. E. BRANDES (U.S.A.), Chairman, is preparing a committee report, and will shortly forward several papers on pathological topics.

Insect Pests of Sugar Cane.—The following papers have been promised. D. L. VAN DINE and L. D. CHRISTENSON (Cuba) : A revised list of the insects injurious to sugar cane in Cuba, together with their parasites, predators, associates and attendants. J. G. MYERS (British West Indies) : Biological control investigations of sugar cane pests in the West Indies and British Guiana. H. E. HAZELHOFF and P. C. HART (Java) : Investigations about the white top borer. J. W. INGRAM (Louisiana) : Soil animals injuring sugar cane in Louisiana. R. H. VAN ZWALUWENBERG (Hawaii) : Nematodes attacking sugar cane roots in Hawaii. C. E. PEMBERTON (Hawaii) : Recent Introductions of insects beneficial to the sugar cane industry of Hawaii. By the same author : Insect damage to sugar cane roots in Hawaii. U. C. LOFTIN and L. D. CHRISTENSEN (Cuba) : Report on the corn aphis, *Aphis maidis* Fitch in Cuba. H. K. PLANK (Cuba) : Seasonal development of *Diatraea saccharalis*, and its principal parasites in Cuba.

Some of the papers listed above will be of interest to both entomologists and pathologists, and it has been proposed that these be presented at a joint meeting of the two sections.

Committee on Diseases of Sugar Cane.—The Acting Chairman, M. T. COOK (Puerto Rico), in co-operation with committee members and others, has conducted an international survey of the diseases of sugar cane, and a report on this, supplemented by maps, tables, and charts, will be presented at the Congress. The field control of mosaic will be the subject of a special discussion, to be led by J. P. MARTIN (Hawaii), and JULIUS MATZ (U.S.A.). There will be two papers by A. P. D. MCCLEAN (Natal), on the behaviour of the cane variety POJ 213 towards streak disease, and on mosaic disease, with special reference to its eradication from South Africa. J. F. DASTUR (India) will have two papers, on Sugar cane mosaic, and on Control of *Striga* spp. on sugar cane in the Central Provinces of India. D. S. NORTH (New South Wales) will also contribute two papers, on obtaining resistant varieties for the control of gumming disease, and on Pokkah Boeng. R. CIFERRI (Santo Domingo) has announced two papers, on Variations in thickness of mottled and healthy cane leaves, and on the Measurement of intensity and variations of discolorations of sugar cane leaves. Six papers are to be contributed by M. T. COOK (Puerto Rico), as follows : Proof of the parasitism of *Marasmius sacchari Wakker* ; Rotting of seed cuttings in Puerto Rico ; Gummosis in Puerto Rico ; Transmission of sugar cane diseases by cuttings ; Dry top rot ; *Melanconium sacchari*. Another paper by the same author, in collaboration with F. CHARDON, is entitled : Resistance and susceptibility to *Ligniera* (*Plasmodiophora*) *vascularum*. J. P. MARTIN (Hawaii) will submit papers on transmission of sugar cane diseases by cuttings, on Adventitious growths of sugar cane, and on Seed borne diseases of sugar cane. E. V. ABBOTT will have two communications, on Rotting of seed cuttings in Louisiana, and on the Sugar cane disease

situation in Peru. Further papers include: Mosaic phenomena in some POJ varieties, by R. D. RANDS and E. M. SUMMERS. Experiments to test the difference in yield between sugar cane with disease and free from mosaic disease during the season 1930-31 in Pusa, by W. MCRAE (India); Root pressure liquids of the sugar cane plant, by WELLER; Disease resistance trials, by A. F. BELL (Queensland); Desirability of testing new varieties of sugar cane for their susceptibility to root disease fungi, by H. R. BRITON-JONES (British West Indies); Red Rot disease, by E. C. TIMS and C. W. EDGERTON (Louisiana); Parasitism of *Aeginetis Indica* on sugar cane, and its natural control by hyper-parasites, by ATHERTON LEE (Philippines). There is also planned an exhibit of photographs of diseases of sugar cane from different parts of the world.

Committee on Varieties.—T. S. VENKATRAMAN (India), Chairman, sent to the members of his committee a questionnaire, asking for the names of original or seedling varieties exhibiting certain characteristics specified in detail; the conditions which affect arrowing, and the fertility and viability of pollen; the exact methods of pollination and breeding, collection and storage of sugar cane seed, methods for sowing cane seed and for accelerating germination, mortality after germination; methods of eliminating and selecting seedlings under various conditions. In addition to the general report based on this questionnaire, the following papers have been promised for the programme. G. BREMER (Java): Cytological studies on the indigenous Indian sugar canes; F. A. LOPEZ DOMINGUEZ (Peru, now Puerto Rico): Sugar cane varieties grown in Peru; and Sugar cane breeding in Peru; R. L. DAVIS (Puerto Rico): Sugar cane crosses with Kassoer selfs; T. S. VENKATRAMAN and R. THOMAS (India): Intergeneric hybrids between sugar cane and sorghum.

Committee on Cultivation and Field Operations.—The Acting Chairman, R. FERNANDEZ GARCIA (Puerto Rico), will present a brief report on the activities of his committee, and he announces the following papers to be presented: Cultivation and field operations in Puerto Rico, by MCCONNIE, DE CELIS, and OBEN; Ratoon cultivation, by W. W. G. MOIR (Hawaii); four papers on Cultivation experiments, by P. E. TURNER (British West Indies); Water culture experiments on sugar cane, by JOSÉ PARDO (Peru).

Committee on Factory Operation and Control.—A formal announcement of the programme of this committee has not been received as yet from its Chairman, W. R. MCALLEP (Hawaii). M. R. DIAZ (Puerto Rico), F. GUERRERO (Cuba), and E. T. WESTLY (Philippines) have been appointed members of this committee. Papers are known to have been promised by E. C. VON PRITZELWITZ VAN DER HORST (Java), on Direct versus alternating current for mill drives; by E. T. WESTLY (Philippines), on Clarification; by M. R. DIAZ (Puerto Rico), on Evaporators and evaporation; by A. L. WEBRE (U.S.A.), on Recent developments in evaporation as exemplified by performance of the Clewiston sugar factory; by F. GUERRERO (Cuba), on Methods of sugar factory operation in Cuba. A special symposium on crystallization will be conducted by P. HONIG (Java). This will cover the fundamental scientific as well as the technical phases of the subject, and some authorities outside the circle of sugar cane technologists have been invited to contribute to this symposium. The following papers have been promised so far: by F. P. PHELPS (U.S.A.), on the Crystallography of the sugars; by G. L. CLARK (U.S.A.), on X-ray crystallography as an aid to the sugar technologist; by P. HONIG (Java), on Experiences with various new types of crystallizers, and on Automatic boiling control; by K. SANDERA (Czecho-slovakia), on the Effect of colloids on crystallization; by J. C. KEANE and E. K. VENTRE (U.S.A.), on Effect of pan construction and of boiling systems on syncrystallization of impurities; also a paper by H. F. BOMONTI (Hawaii), on Results of crystallization investigations in Hawaii.

Special Committee on Description and Identification of the Original Cane Varieties. W. W. G. MOIR, Chairman, has collected data on this subject from all over the world and has prepared a comprehensive report to be submitted at the Congress.

Special Committee on Uniformity in Reporting Factory Data.—The Chairman, F. W. ZERBAN (U.S.A.), has compiled the replies to three questionnaires, sent out to the members of the committee, and dealing with methods of boiling-house control,

methods of weighing, measuring, and sampling, and methods of analysis, respectively. The report based on these replies, with recommendations, will be discussed by the committee when it meets at San Juan, and the final report will then be presented to the Society for appropriate action.

Special Committee on Soils.—OSWALD SCHREINER (U.S.A.), Chairman, will present a committee report at the Congress. He and R. B. DEEMER (U.S.A.), have prepared a bibliography of the literature on soil science, comprising about one thousand titles of interest to sugar cane technologists, and covering soil research of practically all the sugar cane countries of the world. It is intended to issue this in mimeographed form for the use of the members. The bibliography has been arranged in harmony with the general consideration of the soil section of the Congress, being divided into four parts, viz. Soil survey and classification of soils ; Soil examination and analysis ; Fertility and fertilizer investigations ; Irrigation and drainage. In addition, a number of papers have been announced for the programme ; C. F. MARBUT (U.S.A.), Soil genesis and classification ; F. HARDY (British West Indies), Some aspects of cane-soil surveying ; also, Significance of the soil profile in cane-field studies ; R. FERNANDEZ GARCIA (Puerto Rico), Aspects of soil surveying : also, Sugar cane soils of Puerto Rico ; H. H. BENNETT (U.S.A.), Soil type in relation to sugar cane in Cuba ; JAMES THORP (U.S.A.). Methods of soil classification in different sugar cane countries ; R. C. ROBERTS (U.S.A.), The soils of Puerto Rico ; A. M. O'NEAL (U.S.A.). Soil research in the sugar cane district of Louisiana ; R. V. ALLISON (U.S.A.) Use of the less common elements as soil amendments for sugar cane production in Southern Florida ; W. W. G. MOIR (Hawaii), Hawaiian soils and fertilizer research ; N. CRAIG (Mauritius), Soil research in Mauritius.

Committee on Technique of Field Experiments.—According to a letter received from the Chairman, GEORGE ARCENEAUX (Louisiana), this committee will conduct a symposium on the subject, and as a result of this symposium expects to make a committee report embodying specific recommendations relative to plot technique problems as applied to field experiments with sugar cane. The titles of two papers have already been announced, by R. J. BORDEN (Hawaii), on Effect of size and shape of plot on the experimental error ; and by E. E. NAQUIN (Hawaii), on Border effect in field experiments. Three other papers are in the course of preparation.

This general outline of the technical programme of the Congress proves the great interest being displayed everywhere in all the phases of sugar cane technology. The diversified programme, the opportunity to see the Puerto Rican industry in action in both field and factory, to view the exhibits of sugar machinery and supplies specially arranged for the Congress, to exchange ideas with brother technologists from all over the world, and to enjoy their company at the various social gatherings, all these will offer a strong incentive to progressive men to undertake the trip to Puerto Rico. Some of the countries located at a great distance from the meeting place have already announced the names of their delegates. Java will be represented by P. Honig, and O. POSTHUMUS ; Natal by H. H. DODDS, G. C. DYMOND, and A. C. WATSON, possibly also A. P. D. MCLEAN ; Queensland by G. S. MOORE and probably by A. F. BELL. Attendance by delegates from Cuba and the United States is assured. As the Congress is still several months off, no definite information has been received yet from other countries, but it is expected that most of them will send some of their leading technologists. A cordial welcome and a profitable and enjoyable time is in store for them in Puerto Rico.

PATENT SPECIFICATIONS.—It is now announced by H.M. Stationery Office, London, that the Group Abridgments of U.K. patent specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2., either sheet by sheet as issued on payment of a subscription of 5s. per group volume, or in bound volumes price 2s. each, and that the full specifications can be obtained from the same address price 1s. each.

A Wholly Automatic Electrode for *pH* Measurements.

By H. D. VAN OORT.

It is obvious that a recording apparatus is much better for factory control purposes than non-recording methods, in which latter case one is dependent on the care and accuracy of those operating them. American investigators have occupied themselves with the utility of the antimony and tungsten electrodes.[1] In 1923 an electrode for flowing liquids was constructed by ATEN and VAN GINNIKEN,[2] which made it possible to determine the *pH* of some liquids under laboratory conditions.

This electrode consists of a glass reservoir, connected with a vertical glass tube with cock, the tube ending in a pear-shaped glass bulb, with the apex downwards. In the upper part of this bulb hydrogen was conducted through a second glass tube ending near the first mentioned. The apex was open, and was connected with a vertical glass tube. at the end of which a capillary rose at an angle of 60°. At the end of the vertical glass-tube, opposite the rising capillary, a little piece of alundum was sealed in, allowing drops of liquid to come through. The calomel electrode was furnished with a descending glass tube, at the end of which a second piece of alundum was sealed in. By means of these two pieces, electrical contact between both electrodes was formed.

This electrode had several drawbacks. Firstly, the glass reservoir had to be filled regularly, otherwise air ran down into the "pear," mingling with the hydrogen, which latter moved the liquid along the platinum electrode in the upward capillary. Then the electrode had to be re-filled with pure hydrogen. Secondly, it was not possible to connect the apparatus to a quick running stream of liquid. Thirdly, the stopcock did not drop consistently and the platinum wire was poisoned by some unknown substances in the beet juice. Hence the potential found was too positive, and accordingly the *pH* too low.

The present author has tried to adapt the apparatus to factory use. By means of considerable financial help from the Friesch Groningsche Co-operatieve Beetwortelsuikerfabriek at Groningen, Holland, and the valuable advice of Prof. Dr. A. H. W. ATEN and IR. A. F. HULSEWÉ at Amsterdam, he succeeded in constructing an electrode, which produces diagrams of the *pH* of second carbonatation juice with scientific accuracy, and needing only little care. The principle of the electrode of ATEN and VAN GINNIKEN described above was not altered, but in order to avoid irregularities in the dropping rate of the stopcock, an arrangement for constant pressure on the aforementioned cock was constructed; but as this was not quite satisfactory, it was after the campaign of 1929 replaced by an automatic valve.

This valve opened by a flow of juice, of sufficient strength, running through the vessels 18, 12 and 4. Then alternating current was passed through the liquid between the two electrodes 14; electromagnet 1 started working and ball 9 was allowed to rise, when 92 on the automatic recorder made contact. When the stream of juice ceased, the ball closed automatically. It was necessary to isolate all metal parts in vessel 12, except the blades 14, otherwise water containing ammonia would conduct the current along the walls of the vessel, when the juice supply had stopped. It is also necessary to construct the automatic valve, enclosed in 4, very rigidly and accurately, making the ball and its seat 11 of steel, and grinding them very accurately (see Fig. 4).

1 *Ind. and Eng. Chem.*, 1928, 87, 348, 1148; 1929, 965. *Amer. Chem. Soc.*, 1928, 2125.
2 *Receuil des Travaux Chim. Pays Bays*, 1925, p. 1012.

Experiments were carried out in the campaigns of 1928 and 1929 without the automatic valve and the platinized gauze 61 ; and in 1930, with the electrode in its latest construction (see Fig. 4). The diagrams of the *pH* of beet juices, produced with these electrodes and by the LEEDS and NORTHRUP recorder, were very clear. It appeared that a very remarkable difference between mechanical defects of the apparatus and physico-chemical disturbance of the electrode could be detected. Both of them were distinctly separated from the deviations, caused by a faulty control of carbonatation.

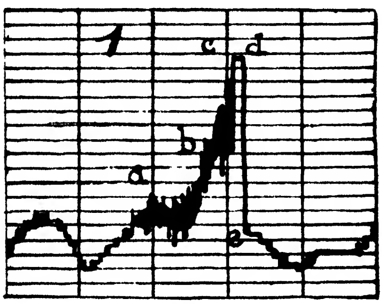


Fig. 1.

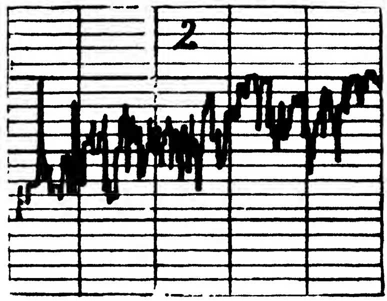


Fig. 2.

The first-mentioned deviations were marked by typical diagrams. Lack of juice, lack of hydrogen and loose contact were marked by an abnormal long straight line (Fig. 3, *c—d, e—f*). The diagram of the second-mentioned group of deviations (poisoning), is shown in all its graduations in Fig. 1 (poisoning by unknown substances in the juice); and poisoning by oxygen in Fig. 2 (intentionally caused by opening stopper 58). The disturbance of diagram 1 consists of an irregular to-and-fro movement of the pen, followed by a slow movement to the positive side of the diagram. The abscissae are divided into

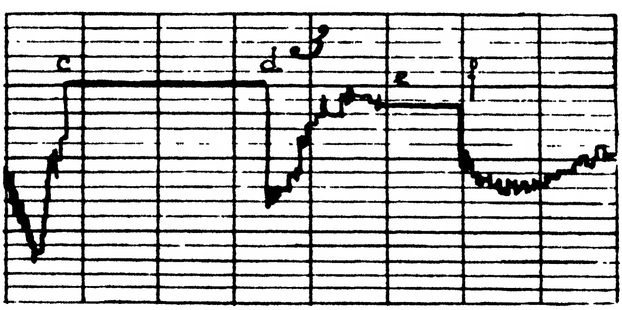


Fig. 3.

periods of 10 minutes each ; and the ordinate represents the potential ; in diagrams 1 and 3 each division is 0·1 *pH* ; in 2 it is 2·5 *mV*.

At *c* the contact 74 is loosened to replace wire 79 by a new one ; at *d* a new one is put into 78 and contact is formed again, the original potential being re-established. When contact is made immediately after putting in the new wire, a very high positive, quickly becoming a more negative potential is registered. It is shown by a line perpendicular to the length of the roll.

The part on the right of *f* in Fig. 3 is a normal diagram. By means of this apparatus it is easy to judge the work of the man at the carbonatation.

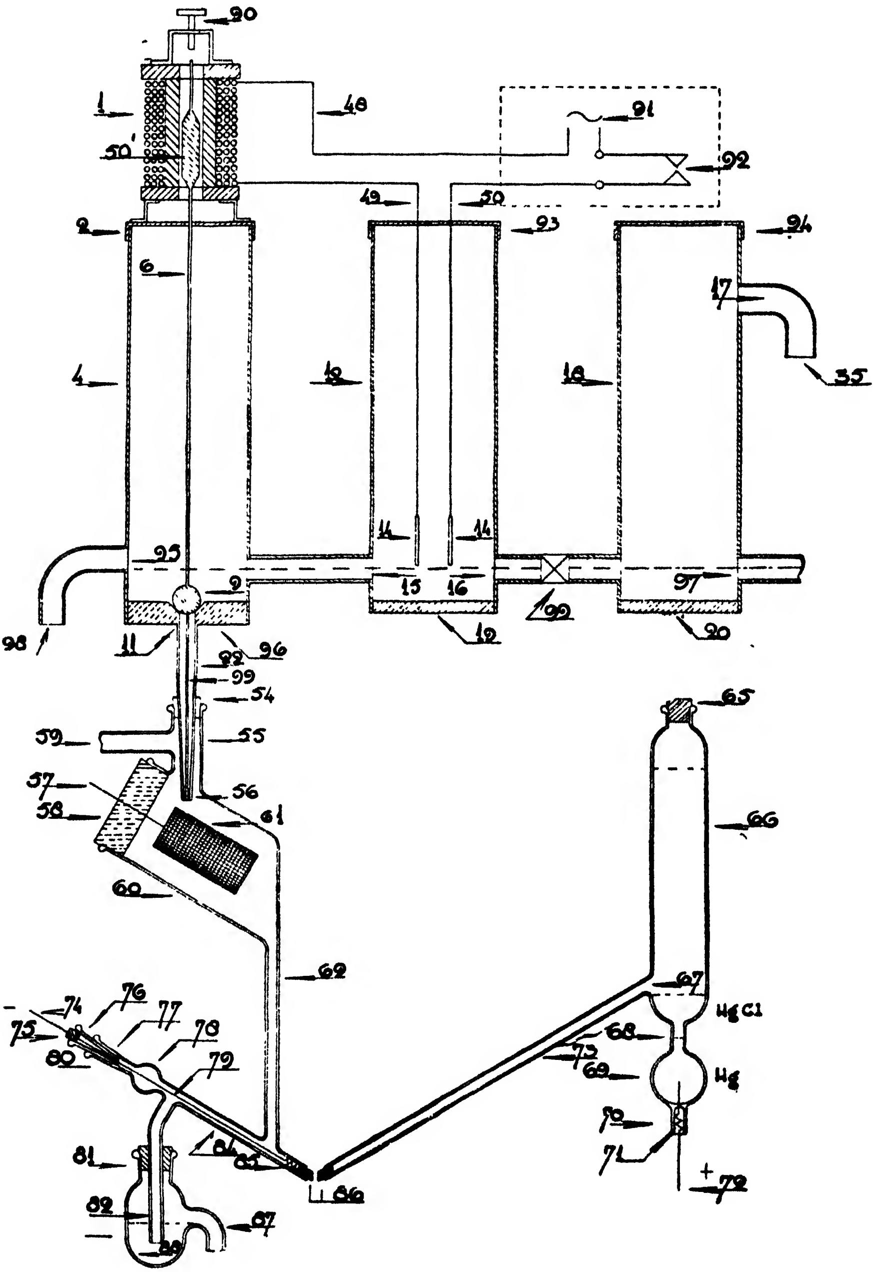


Fig. 4.

He himself cannot see the diagram ; but he sees a milli-voltmeter deviate from its zero-position when he is mistaken. This millivoltmeter is part of a Wheatstone's bridge formed by the recorder, and two special resistances.

The electrode furnished with automatic valve worked very satisfactorily. The platinum gauze too served well, and caused a distinct diminution of the poisoning of the electrode. A special report about this gauze will be found in a following article.

Some facts to be noted are : Electrodes 14 are made from nickel, vessel 12 is wholly isolated, 91 represents the input of A.C., 92 is a contact mounted by us on the spindle of the recorder. The automatic valve is made of copper, except the two electrodes 14 ; the rubber stoppers 54 and 58 are put into the glass part 60 ; 66 is a saturated KCl calomel cell closed with rubber stopper. Platinum wire 72 is sealed with sealing-wax in the glass 71 ; 88 is a washbottle preventing air coming into 87. The dropping speed can be altered by screwing in and out 90 ; a speed of one drop per 2 seconds is quite sufficient. The hydrogen comes in at 59 at the rate of one bubble a second. The juice comes in at 97 and leaves at 98 ; and 35 is an overflow.

Bagasse Utilization.

For the Production of a Cheap and Effective Plastic.

A very simple method of making a moulded product has recently been patented, in which use is made of cheap cellulosic materials as sawdust or bagasse. This is treated so as to liberate the binder in it, which is precipitated upon the separated fibres. It thus forms a cheap, mouldable composition.

Thus, for example, 6 lbs. of sawdust or bagasse, 2 lbs. of caustic soda, and 1 gallon of water are placed in a digester and treated with steam at about 160 lbs. pressure for 3 to 4 hours. About 3½ lbs. of concentrated sulphuric acid in 3 to 4 gallons of water are next added. This precipitates resinous products. The mass is filtered and washed until the filtrate is neutral and free from sulphate. After drying in the air at about 80°C., an alkaline substance (e.g., 3 per cent. of lime) is added and the product thoroughly mixed in a ball mill or tumbling barrel, or otherwise to form a powdered compound ready for moulding.

This compound is placed in moulds and subjected to heat and pressure. Under these conditions certain constituents of the mixture become plastic and the material flows taking the exact shape of the mould. Usually in a few minutes, the mass becomes hard and infusible, but the moulded article may be removed from the mould while hot without distortion. Such moulded articles are hard, strong, and smooth, and are not affected by atmospheric moisture. They may be moulded into various desired forms, and the colour can be varied by the addition of suitable dyes or pigments before moulding Various fillers or strengthening agents may likewise be added before moulding.

Here then is a method of utilizing bagasse that may be of great interest. It is invented by FREDERICK H. SMYSER, of Marblehead, Mass., U.S.A., and covered by him in U.S. Patent 1,792,254, which is assigned to the General Electric Company. Such a process should not require any very costly plant, and should be easy and cheap to operate. It could be applied on the plantation for making blocks and boards, and the material moulded could no doubt be rendered rot-and-insect proof by suitable additions.

Recent Work in Cane Agriculture.

REPORT OF THE GENETICIST, AGRICULTURAL DEPARTMENT, BARBADOS, 1930-1931. **A. E. S. McIntosh.**

The crossings of the year were between, as females, Ba 11569 and certain POJ seedlings, 2364, 2725, 2354, 826 and 2379 and Uba, and as males only Barbados seedlings. The male parents were, in every case, BH 10 (12); and certain other Barbados seedlings, namely, B 606, 891, 391, 755, 417, 663, 605, 374 and 726, all of them with Ba 11569 as female and a few with the five Java seedlings and Uba. In all, 29 crossings were effected, and the knowledge gained in 1928 and 1929 on pollen shedding was taken advantage of, for the selection of male parents and for choosing the times for cutting the arrows and dusting the female arrows with pollen.

Particular attention was devoted during the year to the relation of several male parents between certain pollen features mentioned below and their ability to produce seedlings when crossed with Ba 11569, the standard Barbados female. The mean germination per seed box had been studied for several years, and such as had been determined, for the nine Barbados parents used, in 1928, 1929 and 1930, are summarized in a Table. Pollen shedding capacity was also studied during 1929 and 1930, and the following arbitrary classification had been arrived at : high pollen shedding B 391, BH 10(12) and B371 : intermediate B 606, B 605 and B 417 ; and lower B 891, B 755 and B 726. The correspondence between this and the germinations per seed box with Ba 11569 as female parent is fairly close, the exceptions being B 374, B 755 and B 417.

Other features studied in the pollen of these nine male parents were made under the microscope : the percentage of abnormal grains, of normal grains staining with iodine, and the diameter of the grains. When those features were compared with the capacity for producing seedlings with Ba 11569, there appeared to be no connexion between seedling production and the two latter features, but a high percentage of normal grains appeared to accompany high seedling producing characters. In general, the Java × Barbados crosses are less fertile than the Barbados × Barbados crossings, and for any female different male parents show differences in the viability of the seedlings. Comparable fuzz with different lanterns gave wide divergences in germination, showing that other factors are present which exert a much greater influence. The time allowed for seed maturation after picking showed that 3 days was more favourable to high germination than either 8 or 14 days.

A Table is presented of the seedlings planted out during the year, these have been selected, as in previous years, during the potting stage, since the more vigorous had been proved to produce an average greater weight in the seedlings. They did not undergo the special "batch" tests, as the results obtained during the previous year did not yield sufficiently high corelation coefficients to justify repeating for the present. The Barbados × Barbados seedlings occupied over three quarters of the holes, and the rest Barbados × Java seedlings. The 6000 seedlings planted out were divided into early and late cropping, and not as usual into early, medium and late, although no remark is made on this change.

The first year seedlings, bred in 1929 and planted out in April 1930, were reaped during the year. The early reaping was in the middle of January, the medium in the beginning of March and the late in the middle of April. The procedure for each group was the same. "For purposes of field selection each seedling had the following features noted (1) habit (2) thoroughness of trashing (3) number of canes (4) length and width of an averaged sized cane

(5) weight of stool. Since all except (2) are certainly influenced by place in the field, each two thousand group was sub-divided into smaller blocks and selection made within blocks. In all approximately one hundred and twenty seedlings were selected in each group in the field. Each bundle was divided into two, so that there were comparable pairs in each half. One half was sent to the mill for sucrose percentage in juice determinations, while the other half was retained at the experimental station. The latter provided a sample for observing the types of the canes in the seedlings. Thus, with all features ascertained, a final selection of twenty seedlings was made in each group. Field characters were obtained for all members of each population, while sucrose percentages were determined for a sample number of each population; such numbers being selected from all parts of the experimental area."

A series of Tables give indications in each group of the relative performance of each cross population reaped. The percentage of final selection was: in the early group led by Ba 11569 × B 417, Ba 11569 × BH 10(12), and Ba 11569 × B 891: in the medium group by Ba 11569 × BH 10(12), Ba 11569 × Ba 6032, which equalled Ba 11569 × B 417, and in the late group POJ 2726 × BH 10 (12), Ba 11569 × Ba 6032, Ba 11569 × BH 10 (12).

Then follow a series of similar Tables with the relative merits of cross populations as regards the special features examined : in early and medium groups the weight of stool, sucrose in juice, number of canes in stool, width and length of canes, and number of rotten canes in the stool. A certain deviation occurred in the late group, which was subjected to an unusually long dry season before cutting: many canes were completely dry and even whole stools.

The discussion of these Tables. The data provide, for Barbados, a clear impression as to the seedling populations likely to produce seedlings resistant to a prolonged drought. Thus far, only noble "blood" has been used in the parents, which may restrict features of value; but in 1928 Java canes with *Glagah* nobilization were introduced as parents, which have increased the range of variability. Of greatest importance perhaps is the increased weight of the crossings with Java canes: this is especially seen in the crossings with POJ 2364 and POJ 2379, the mean weights of these crosses being 20 to 30 per cent. higher than purely Barbados crossings. These increases are specially seen in the late group, from which it may be argued that resistance to drought is increased. Further, it is clear that the sucrose percentage of these Java canes has been raised. From maturity experiments, POJ 2364 had an average of 13 to 14 per cent. of sucrose, and POJ 2364 did not exceed 15 per cent. sucrose in its juice. In the crosses between them and Barbados canes the averages are higher, and in some cases reached 18 per cent.

The seedlings of POJ 2364 crosses have an excellent appearance, which is not the case with POJ 2379, while POJ 2725 crosses do not appear to increase the weight of Barbados crosses. Seedlings of Co 213, while giving good weights are (as might be expected)[1] only mediocre in juice qualities, and their appearance is against them, so that they do not suggest a promising line for further trial at present.

Within the Barbados crossings smaller differences occur, but Ba 11569 × BH 10 (12) produce seedlings with good weight and very fine juice; other male parents produce seedlings with good weight or good juice, while some are definitely inferior in these respects. But most of the crosses will be continued because of the abnormal rainfall conditions, and especially for different

[1] The stage of nobilization is extremely low in both parents, but it seems to be promising for breeding purposes *with* nobilization.

rainfall areas. The most promising line of work in breeding appears to be back-crossing the POJ 2364 × Barbados seedlings with high sucrose conducing parents, such as BH 10 (12), B 891, and B 417.

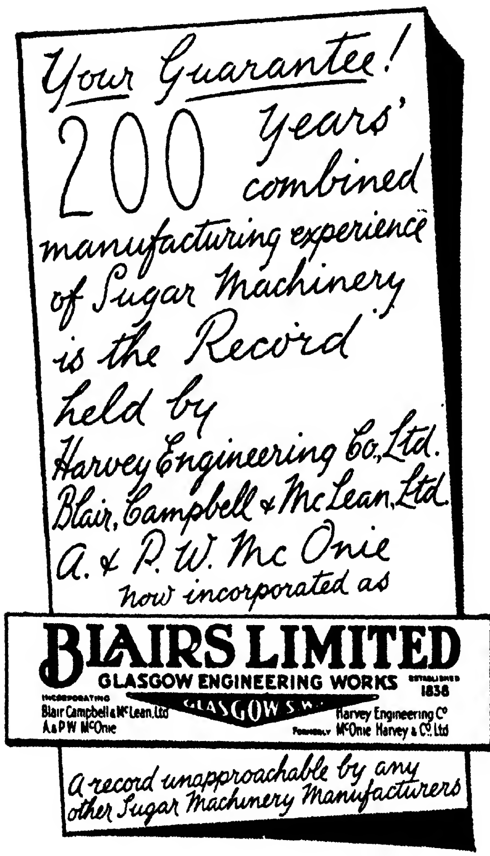
Further studies are described as to correlations between the performances of seedlings during successive years, especially as to weight and sucrose content. These have been going on for some time, and the successful results of 1928-1929, of correlation between seedlings of the first and second years, have been carried on to the third season, and again gave significant coefficients of correlation, although it is surmised that a better result would have been obtained by restricting the area from which the seedlings were drawn.

Second year seedlings, selected in 1929, multiplied during that year and planted in trial plots in November, were reaped; and have been selected as follows for further, large scale trials : early group two for wet districts and three for dry, medium group three for wet and six for dry, and late group two for dry districts.

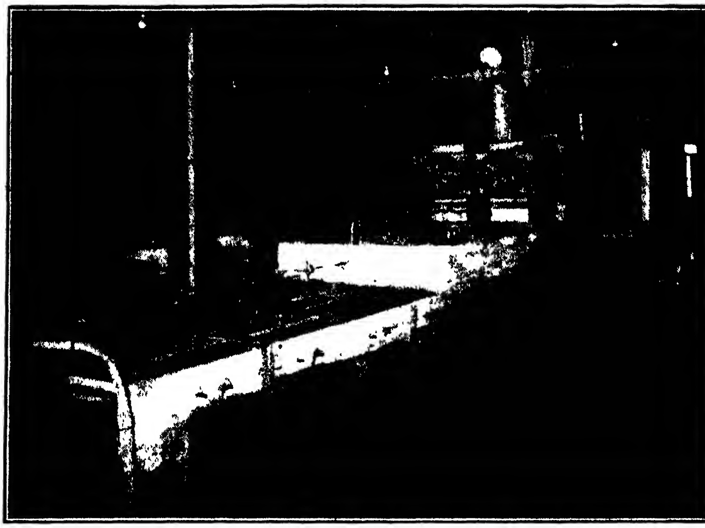
Sugar cane variety maturity experiments :—These were conducted with 16 varieties in the two different rainfall districts : Graeme Hill where the rainfall during the growing period (17 months) was 40·21 ins., and Vaucluse where it was 58·35 ins. The results in weight of canes and percentage of sucrose in the juice are shown on diagrams, each with the three different periods of cropping, early, medium and late. "The object of these experiments is two-fold. They are designed to obtain information as to the general effects of 'place,' variety and time of reaping on weight, its contributory factors (numbers of canes, length and width of canes, occurrence of rotten canes) and percentage of sucrose in the juice, for the three periods in cropping, early, medium and late. They also serve to give information on the responses by Barbados varieties, imported varieties and promising seedlings to place and time of reaping. This information is used in the selection and grouping of parental material in breeding, and also assists with planting recommendations for the various parts of the island." It may be noted that, in sampling the canes for analysis, some attention is paid to the stages of development of the shoots, *a*, *b*, and *c* being separately examined. There are interesting points raised in the discussion of the results as shown in the diagrams, but we have not space here to deal with these. The same applies to the section on variety trials made at six stations : the results are here also given in diagrams, a form of representation which is very striking. Further sections deal in this report with experiments on resistance to gumming, spacing experiments and a cutting back experiment.

ANNUAL REPORT OF THE INSULAR EXPERIMENT STATION OF THE DEPARTMENT OF AGRICULTURE AND LABOUR OF PORTO RICO. 1929-1930 : issued 1931.

The Director, R. FERNANDO GARCIA, reports a much greater appreciation of the work at the station by the farmers and Corporations ; and the latter co-operate in establishing experiment plots all over the island. In particular centrals have assisted financially in the soil survey undertaken by the Bureau of Chemistry, and not only in their own fields but in the country surrounding them. Although the island is still suffering from the terrible hurricane of 1928, the budget of the station has been retained. The sugar crop for the year has surpassed the previous record by fully 100,000 tons ; and, with the new varieties and seedlings, there is every prospect of the million mark being reached within the next few years. It is satisfactory to note that the exodus of the personnel of the station staff, which has so largely hindered the scientific



See *INTERNATIONAL SUGAR JOURNAL*, 1930, pages 534-535.



work in previous years, has been checked. Considerable improvement in the technique of the field experiments has been introduced during the last two years : no field test in varieties or fertilizers is being laid down with less than four replicates, and more often with six or eight ; the plots are sown with the same number of three-eyed sets and guard rows established all round them. The experimenter can thus calculate the probable error or other statistical index of the results, so as to determine the degree of confidence which can be placed upon them. In seedling work the policy has been adopted to concentrate on two or three crossings which have in previous years proved to yield a great number of promising seedlings, and to try on a small scale as great a number of combinations as possible, to discover parents for future crossings. This year POJ 2725 × D 1135 and POJ 2725 × SC 12(4) have been the chief crosses, while good results as to numbers have been obtained with POJ 2725 × POJ 2728 and POJ 2365 × SC 12(4).

Seven variety experiments were harvested as plant canes, with the intention of growing the plots for two more years as first and second ratoons, as this is the customary rotation on the plantations where the experimental plots have been established. The cultivation and fertilization given in these plots was that of the commercial canes grown for the local Centrals. These experiments will give some idea of the outstanding varieties being tested against the standard canes grown, as well as throw some light on some of the varying conditions of soil and rainfall in Porto Rico.

(1) Central Constancia, Toa Baja : without irrigation, on alluvial land with porous sub-soil. Sixteen varieties compared with BH 10(12), none of which out-yielded it. The average yield of this cane in 20 plots was 37·97 tons of cane and 4·67 tons of sugar ; and its nearest competitors were Ba 7924, with 33·07 tons cane and 4·07 tons sugar, and Ba 8069 with 33·77 and 4·03 respectively. The rainfall was 82·06 ins. in the 15 months of growing period.

(2) Colonia Fe of Central Mercedita, Ponce : irrigated, an alluvial soil with compact subsoil, rainfall during 14 months 29·21 ins. The average yields were : SC 12 (4) 57·06 tons cane and 7·07 tons sugar ; BH 10 (12) 56·29 and 6·77 ; Co 281 58·47 and 6·57 ; and B 417, 45·25 and 5·55 respectively.

(3) Central Juliana, Villalba : without irrigation. BH 10 (12) was a complete failure : " it is not a cane for the very dry rolling country in this section of the island." The rainfall was however 62·80 ins. in 14 months. The average yields for the canes tested were : POJ 36, 28·76 tons canes and 2·73 tons sugar ; Co 213, 24·48 and 2·60 ; Uba 29·23 and 2·51 ; BH 10 (12), 17·54 and 1·97. The differences in the first three are not significant and it is remarked that "Co 213 should be tried again in this and other similar districts."

(4) Central Los Canos, Areciba : alluvial soil with rich deep subsoil, irrigated, rainfall 55·65 in. in 14 months. The average results were : B 417, 38·80 tons cane and 4·83 tons sugar ; Co 281, 39·50 and 4·67 ; BH 10 (12), 40·15 and 4·41 ; SC 12 (4), 36 and 4·29 respectively.

(5) Central Victoria, Carolina : unirrigated alluvial soil with heavy semi-compact subsoil, with 63·90 ins. rainfall over 13 months. The yields were : SC 12 (4), 34·36 tons cane and 4·60 tons sugar ; BH 10 (12), 35·40 and 4·59 ; Co 281, 31·71 and 4·10 ; B 119, 23·60 and 3·12 respectively. The difference between the first three is not biometrically significant, but B 119 is decidedly inferior.

(6) Hacienda Josefa, Central Aguirre : rich alluvial soil with very porous subsoil, irrigated, rainfall 49·88 ins. over 13½ months. Results : POJ 2878, 73·77 tons cane and 8·56 tons sugar; BH 10 (12), 65·57 and 7·91 ; SC 12 (4), 61·16 and 6·61 respectively. At harvest time it was noted that POJ 2878 had

developed abundant water shoots and arrows, and the upper third of the cane was becoming pithy.

(7) Colonia La Vega, Central Cambalache, Arecibo : unirrigated alluvial soil with porous subsoil, rainfall during 12 months (April to March) 47·10 ins. Resulting yields : POJ 2878, 59·45 tons cane and 6·81 tons sugar ; SC 12 (4), 40·17 and 5·07 ; BH 10 (12), 41·82 and 4·84. None of the three canes arrowed, and the canes were not fully matured, especially in POJ 2878 which was also seriously attacked by borer.

There are many matters of interest in these comparative yields, especially in the Java and Coimbatore canes, and the further yields in first and second ratoons promise to solve some of the doubtful points. Twelve other experiments on similar lines on different centrals, including other seedlings, different times of planting and spacing, are then described. The breeding work is described by T. BREGGER, the plant breeder. The 1928 and 1929 seedlings and twenty-eight of 1925 are separately treated, but in so compressed a form that the results can only be studied by reprinting the Tables presented. An interesting comparison is appended between the germination merits of top seed, bottom seed and "rajoengans" ; the results being 26 per cent., 20 per cent. and 82 per cent. respectively.

EFFORTS TOWARD BIOLOGICAL CONTROL OF THE COMMON PINK MEALYBUG, *Trionymus sacchari* OF THE SUGAR CANE IN NEGROS. **F. C. Hadden and A. W. Lopez.** *Philippine Journal of Science*, Vol. 46, No. 2, 1931.

The pink mealybug is usually less important in Negros than in Luzon, but it is numerous in Negros at present because of the dry weather, which inhibits its natural enemy, the fungus Aspergillus. Two new natural enemies have been liberated by the Philippine Department of Entomology in Negros.

(1) A species of Scymnus (Pullus according to Swezey). A ladybird small enough to penetrate between the leaf sheath and stem, where the pink mealybug is accustomed to congregate : it devours the young mealybugs and is therefore a predator. Its life history is completed in one month.

(2) A small encyrtid wasp, Anagyrus sp. In Hawaii another encyrtid wasp perfectly controls the grey mealybug, and efforts are now being made to establish this new parasite there, in the hope that it will serve for the control in like manner of the pink mealybug. The eggs are laid in the mature or nearly mature mealybugs, the larvae probably entirely devouring the body contents. The life history is completed in from 12 to 16 days according to the temperature. Methods have been devised for rearing both natural enemies and up to December 23rd, 1930, colonies ranging from 40 to 100 individuals have been liberated on some half dozen plantation fields, where the mealybug was plentiful. Stocks are also being kept in the laboratory at La Carlota for further liberations.

REPORT ON A VISIT TO CERTAIN WEST INDIAN SUGAR PRODUCING ISLANDS. **G. H. P. Williams.** *Agricultural Journal of British Guiana.* Vol. 5, Part 3, pp. 117-140. September, 1931.

The notes made on the tour recorded in this paper, by the Agronomist of the Department of Agriculture in British Guiana, are many of them of considerable interest. He visited Trinidad, Porto Rico, Guadeloupe and Barbados, but the bulk of his paper deals with Porto Rico, where soil conditions somewhat similar to those in British Guiana are met with, especially the low-lying parts with heavy clays. The methods adopted in dealing with these are of peculiar interest, and will be chiefly dealt with in this article. But the more general remarks on this successful island are also worthy of

attention just now, because of the approaching meeting of the International Society of Sugar Technologists in Porto Rico : special attention may be drawn to the author's remarks on general and agricultural education. He appears to have been very well received, and any enquiries which he made met with a very ready response.

Porto Rico has 225,000 acres under sugar cane, the chief other uses of the land being for coffee, 172,000 acres (much of which was destroyed in the hurricane of 1928), tobacco 29,000 acres, fruits over 100,000, forests 372,000 and pasture over one million. *Education* is free and compulsory, with large, airy schools in every village and town. The island is bi-lingual, but Spanish is the language of the people. In the schools the junior classes are taught in Spanish, with English as a subject; and the senior classes, as well as the high schools and University, are in English with Spanish as a subject. The course of the agricultural students is being changed from four years of college studies to "two years training in the fundamental sciences underlying agriculture and a certain amount of training in the art. The third year is spent on an approved farm or estate, and after a successful examination, the fourth year is spent on the subject or crop in which the student is most interested." Tuition is gratis, but the students pay their own board in the town adjoining ; so that their full course will not exceed from \$250 to \$300 per annum. On the other hand the College is estimated at costing the Government \$600 per student annually. In the rural districts there are 35 schools teaching agriculture and 10 demonstration farms.

The following *experimental stations* are alluded to : The Insular Experiment Station at Rio Piedras supported by the insular Government, and the Isabela sub-station in the north west of the island where a large irrigation project has been started : supported by the Federal Government, the Porto Rico Agricultural Station at Mayaguez, near to the agricultural college, and the Guyama station, where a large collection of cane varieties which have been used commercially in Porto Rico is kept up. The Fajardo station is maintained and run by the Fajardo Sugar Company, but works in close co-operation with the Government stations, and has fully justified itself by successful experimentation work and the breeding of cane seedlings.

Varieties of cane grown.—BH 10(12) is the most favoured, and it is claimed as the salvation of the industry, but large areas are under POJ 2725 and Uba in dry areas, where irrigation is not available and where mosaic is bad. SC 12(4) is grown in the more elevated valleys, where the soil is lighter and the temperature lower. POJ 2878 is also being grown on a large scale for a thorough trying out, and several thousand acres are under trial for the 1932 crop. But the trial period is not over with this cane, for there is a tendency to uprooting with even moderate winds, and there are sometimes unpleasant surprises as regards the juice. Cristalina, POJ 36, D 433 and D109 are declining, and certain seedlings like FC 916 and PR 803 are being extended. Practically all cane breeding in Porto Rico tends to combine the vigour and disease resistance of the Java canes with the sweetness and other desirable characters of the West Indian canes. As to *cultivation*, there are three types of soil conditions : irrigated lands, non-irrigated undulating, and non-irrigated low flat heavy soils. In the last named, where the soil is stiff and heavy and drainage difficult, a special system has been developed, called the "gran banco." This method is eminently suited to these soils and has been fully described in these pages : in effect, the whole ground is trenched and the soil from the trenches is thrown into narrow heads, each containing two rows of cane about 4½ ft. apart.

The *average yield* of sugar per acre for the island is 3·4 tons, but there are the greatest variations under different conditions, as may be gathered from the following notes of centrals visited by WILLIAMS. Central A: 27 per cent. plant canes, the rest ratoons to the fifth; rain-fed, with 60-70 ins. per annum; yield 32 tons cane and 3·56 tons sugar per acre. Central B: ratooning up to the third year; about 10 per cent. is irrigated and the rest is rain-fed with 70-80 ins. per annum; four years ago the yield was 16 tons of cane, but this year averaged 32·7 tons per acre. Central C: ratooned for one year only to the extent of 30 per cent. of the crop; practically all irrigated; yield last year averaged 47 tons cane and 6·4 tons sugar. Central D: conditions as the last; yield in 1916 27 tons; last year 52 to 56 tons cane and 6·82 to 6·96 tons sugar: details are given for the different treatments, autumn planted 70-73 tons cane and 8·7 tons sugar, spring planted 50-52 tons cane and 6·6—6·7 tons sugar, ratoons 41-47 tons canes and 5·6—6·4 tons sugar. Central E: Section 1: about half plant cane and the rest ratoons down to the third; rain grown with 75-80 ins.: 717 acres of BH 10 (12), 921 of POJ 36, 302 of Uba, and less though considerable quantities of POJ 2878 and POJ 2725; average yield 36·11 tons of cane. Section 2: one quarter plant canes and the rest ratoons down to the third, rain-fed with 100 ins.: some years ago the yield was 12 tons of cane, but the last two years it was 31 and 36. It appears evident from these details that a great improvement has taken place during recent years, probably in the fight against mosaic, the introduction of better canes and heavier manuring. The average rate of the latter is given as 800-1000 lbs. per acre, in two doses, the same for plants and ratoons; the first dose is of mixed fertilizers and the second of ammonium sulphate alone.

A good deal of *mole and tile draining* is being done in Porto Rico. The former with a 4 in. or 8 in. diam. is generally satisfactory for the plant crop, but the drains tend to fill in and surface draining is necessary for ratoons. On one estate where trash is burnt off, the land ploughed and knifed to 12-20 ins., and then moles put in, a 60 H.P. tractor is able to put in a 6 in. mole drain 2 ft. deep, every 12 ft., on 20-25 acres per day, at a cost of 60c. per acre. Central B tried 4 in. and 8 in. moles and found little difference, excepting that the latter required a much more powerful tractor. On the other hand, they have been able to attach a mole to a furrowing plough, and make 12 in. deep furrows and a mole drain a foot lower, at a cost of $3 per acre for the double operation.

Comparatively few data are available for tile draining, but it seems to be very satisfactory in permanently lowering the water table and reducing the excess of salt in the upper layers of soil. The tiles are made of baked clay on the estates, and in one case from cement and sand mixed in the proportion of one to three. Cases of abandoned fields are mentioned from which, after draining, good crops have been reaped. At Central B, 40 acres were drained three years ago, with 12 in. mains and 4 in. tiles two feet below the surface; it appears to have been very effective, but if anything rather overdrained for the dry weather. The distances apart vary with the moisture from 15 ft. to 50 or even 100, and the depth from 2 to 4 ft. Gravel or trash is placed over the pipes before filling in with earth, and sometimes a trough of lumber is put under the tiles in very soft soil to preserve the grade. In sandy soils the salts are reduced markedly in a couple of years, but in heavy clays 4 or 5 years are required for much improvement. Details are given of a wet field in Central Mercedita: yields from 1917 to 1921 were 11 tons, 27, 21, 28, 27: in 1921 tile drains were put in and in 1923 the crop was 65 tons, but this is probably an extreme case.

C. A. B.

Second Annual Conference of the Queensland Society of Sugar Technologists.

In March of this year the Second Conference of this Society had a successful series of meetings at Bundaberg, at which a good number of papers, abstracts of most of which here follow, were read and discussed.[1]

Cane Harvesting and Transport.

In the course of a paper by B. A. Bourke, the cane burning problem was mentioned as one of the great difficulties against which they had to contend in Queensland. Awards permit the burning of cane crops under 12 tons per acre, and in such cases every effort should be made to have such cane delivered as quickly as possible to save loss through deterioration. Say 700 tons of cane are required for starting on Sunday night, and assume this cane has been stored in the yard from Saturday mid-day, the loss in weight would be 9·75 tons, or enough to make 1¼ tons of sugar, assuming all this cane was burnt. This is not taking into account the fall in its C.C.S., which must also be seriously affected. Another difficulty in Queensland met with in cane harvesting is the occurrence of severe frosts, though now by proper transport arrangements, besides the planting of early maturing canes, which if subjected to frost will still mature, losses can be greatly minimized. Progress has been made in the construction of mechanical cane harvesters, but the problem has not yet been completely solved. The Howard Harvester, for example, has been tried out on several occasions, each time with some adjustments, but further improvements have yet to be made. Even if mechanically efficient, the difficulty would be in moving from one farm to another. It is claimed that the Howard machine, said to be lighter and smaller than others, will cut 60 tons per day if working constantly. No grower, however, would be agreeable to cut 60 tons of cane in one day, when the C.C.S. is low and payment is made as at present on the individual analysis system. Again, if the land is very wet a machine could not go on to it this speaker concluded.

Agricultural Value of By-Products.

H. W. Kerr pointed out that analyses have shown that a 20 ton crop of cane carries with it : nitrogen, 36 lbs., phosphoric acid, 17, and potash, 46 lbs. ; or calculated to their equivalents of fertilizer constituents, sulphate of ammonia, 180, superphosphate, 80, and sulphate of potash, 95 lbs., a total of 355 lbs. This of course accounts only for that part of the crop reaching the mill. It is, therefore, worth while considering the proportion of this plant food that might be returned to the land from whence it came. Following shows the proportions of the total plant food constituents of the cane contained in the products of manufacture of five representative Queensland mills :

	Nitrogen	Phosphoric Acid	Potash
Raw Sugar	3	2	2
Bagasse	56	39	23
Molasses	31	24	74
Muds (or press-cake)	10	35	1

On the average 43 per cent. of the total plant foods are concentrated in the molasses, an average analysis of which in Queensland gives : nitrogen, 0·9 ; phosphoric acid, 0·3 ; and potash 3·0 per cent. If these constituents were present in a water-soluble form, they would be readily available if applied to the land, and would be worth on the farm about 28s. per ton. In field trials at the Bundaberg E.S., the average yield of cane plant crops for each series of five plots was : No molasses, 22·7 ; and 10 tons of molasses, 37·1 tons per acre.

[1] For Reports of the First Conference of this Society see *I.S.J.*, 1931, 9 *et seq.*

An average analysis of the dry matter of press-cake showed : nitrogen, 1·6, phosphoric acid 2·3 and potash 0·2 per cent. This dry matter contained 5 per cent. of lime. Press-cake contains about 50 per cent. of water, and press mud about 90 at least ; and in their wet condition the respective fertilizing values of these materials might be placed at 16s. and 3s. 6d. per ton.

Hot and Cold Maceration.

Hot *versus* cold maceration has been brought up at previous conferences ; and as no data have been made available, MAX SMITH decided to carry out careful experiments that might prove of some benefit to those interested. The tests were made at the Mulgrave Central Mill during the latter part of the 1930 season. Four complete runs were made, each comprising one hot and one cold, and all of 3 hours' duration. In the cold tests the temperature ranged from 82 to 109°, and in the hot ones from 160-179°F. The cane in each separate test was as nearly as possible of the same variety and mixture, and the cold tests were taken the day after the hot. The speed of the regulating mill No. 3 was kept as near the same as possible during each test, and it did not vary more than ½ rev. per min. in any particular test. At this mill the Killer patent regulating the engines and mills is in operation, the crushing rate being set at No. 3 mill, so that the others varied automatically. During the tests, readings of the temperature of maceration and the horse power of all engines were taken every half-hour, samples being taken by the chemists during the same period. In one of the tests, the hot maceration temperatures were not quite high enough, and not quite low enough in the cold ones. This showed up in the final crushing rates and other figures ; but it was rectified in the other tests ; still it undoubtedly affected the average results a little. Regarding the results the most important figure is that there was a 6·44 per cent. increase in the tonnage per hour in favour of the cold. On the other hand, there was a decrease of 0·28 per cent. in the extraction. Further, there was an increase in the total horse power of all four engines, amounting to 12·1 per cent. In the cold tests the moisture in the final bagasse was a shade lower, but the sugar content in this material increased a shade.

Treatment of Subsider Muds.

J. V. HAYDEN described a method of working called by hi n the Killer process. It consists of a single clarification of the mixed juice followed by a clarification of the resulting mud after it has been mixed with the total quantity of water allowed for maceration. In the first place, the mud in the juice subsider is drawn continuously into a mixer, while a constant stream of hot water is added to the same receiving vessel, the lime required being added continuously. The mixture is passed through a juice-heater, and admitted to another subsider, the over-flow from which is applied to the bagasse as maceration, while the mud, which gravitates in a thick heavy stream, is run to the drain. It contains from 0·6 to 1·2 per cent. sugar, according to the amount of maceration used. He also mentioned the Paddle process, in which the mud is drawn from the juice subsider, water added, and the mixture limed, heated and subsided. After running off the clear liquor, the remaining mud is again mixed with water, and again limed, heated, and subsided. Mud from this subsiding is sent to the drain, and frequently it has 2 and 3 per cent. of sugar. Hence, the Killer process has many advantages over the other. It is continuous, and almost automatic, whereas the other is a series of operations frequently repeated. The former conserves heat and saves time ; whereas in the Paddle process there is loss both of time and heat.

Besides, the Paddle process does not conveniently admit of the same dilution as that obtained in the Killer process, its loss of sugar being consequently greater. Yet again, the final mud of the Killer is heavy and thick, that of the other being always thin.

Report of Committee on Cleaning Evaporators.

This Report dealt entirely with evaporator scale and its removal. Some good results with "Algaloid" were again obtained.[1] In Mill No. 1, the procedure was to wash all vessels with water, circulate an 0·1 per cent. solution of the "Algaloid" 1 to 2 to 3 to 4 and back to 1, boiling all for about an hour; to leave standing till Sunday night; to then give a further light boil with water; and lastly to run in the juice. After 5 weeks, effect No. 1 was clean, No. 2 had loose scale, No. 3 was clean at the top, with light scale at the bottom, and No. 4 was all clean. This was using about 2500 gallons of water and 10 lbs. of "Algaloid" per week. Mill 4 dissolved 40 lbs. of "Algaloid" in 12-16 gallons of water, and diluted to 6000 gallons with water. This solution went into the evaporator without any preliminary washing, and later another 6000 gallons of water were added. Each week 5 lbs. of the "Algaloid" were added to No. 4 pot. Results of this treatment: no scale left. In another mill a mixture of 75 lbs. of "Wyandotte" and 59 lbs. of tannic acid dissolved in 10,000 gallons of water was boiled up in the several vessels, 5 lbs. of the first and 3 of the second being added weekly. In this way all the vessels were kept clean for 7 weeks, but after that they needed cleaning. In other mills the so-called ferment method was used, that is a solution of molasses was allowed to acidify, and this either sprayed upon the scale, or allowed to stand in contact with it. This method, however, does not appear to have proved successful. Analyses of scales were reported, the results of which varied greatly. One type is evidently a deposit of phosphates of the bases calcium, iron and magnesium; while another appears to be a mechanical deposit of silica and organic matter with small quantities of insoluble salts as binding material.

By-Products.

Discussing alcohol production in Australia, the By-Product Committee mentions that the present yield of molasses in that country is about 120,000 tons per annum. It should be possible to manufacture 6,600,000 gallons of alcohol from the molasses, and about 28,000,000 gallons of alcohol from the 40 per cent. of surplus cane now grown in Queensland. At Sarina the absolute alcohol made is mixed with 2nd grade "Shell" petrol in the ratio of 15 to 85, such mixture being found to give the best results from the fuel economy point of view without alteration being made in the compresion ratios of existing motors. The fuel value of absolute alcohol in terms of m.p.g. is about ¾ that of petrol, so that with petrol at 2s. 4d. per gallon alcohol would be worth about 1s. 9d. On a 5000 gallon output per day, the cost of production amounts to 7·6d. per gallon, and distribution is 9d. per gallon, or a total of 1s. 4·6d. per gallon; therefore raw material at the distillery would be worth 1s. 9d. — 1s. 4·6d. = 4·4d. per gallon obtained therefrom. If petrol advanced to 2s. 8d. per gallon, the raw material could be bought for 7·4d. at the distillery per gallon of alcohol. If freightage were high, no benefit would accrue to the seller of the molasses if petrol were under 2s. 4d. per gallon. Over-production of sugar in Australia amounts to about 200,000 tons per year from 1,400,000 tons of cane; and if the whole of this were converted into alcohol,

[1] *I.S.J.*, 1931, 171.

and the alcohol mixed with 2nd grade motor spirit in the proportion of 15 : 85, sufficient motor spirit could be available to supply the whole of the Commonwealth.

ESTIMATION OF SMALL AMOUNTS OF REDUCING SUGARS.

According to P. J. PHELAN, the α-naphthol method is not only approximate, but at times incorrect, owing to the instability of the reagents. Better results are obtained, he says, with the sensibilator safranin, which is used colorimetrically in the following way : Solution (*a*) 0·1 grm. of safranin in 1000 ml. of distilled water ; and solution (*b*), 10 grms.of KOH in 1000 ml. of distilled water. Equal volumes of these two solutions are taken for a test. To standardize the safranin solution take 0·95 grm. pure sucrose, invert with HCl, neutralize, and make up to 1000, 1 ml. of this solution containing 0·001 grm. of reducing sugars. When carrying out a determination, say in condenser water, invert it in the usual way with HCl, and neutralize, and from this solution make different concentrations. Take as many test-tubes as there are different concentrations, and into each transfer 1 ml. of safranin solution and 1 ml. of KOH. Add 1-3 ml. of the diluted solutions, place in a boiling water-bath, and ascertain the concentration at which the safranin is completely reduced. Reduction is complete when the colour of the safranin solution has changed from red to yellow.

FIBRE DETERMINATION.

MALCOLM B. DAVIS discussed the difficulties of determining fibre. Six sticks of Badilla cane were entirely " fibrated," thoroughly mixed, and the fibre estimated as follows : ½ hour in running cold water, and ½ hour in boiling water, the fibre dried to constant weight, result found to be 10·33 and 10·28 per cent. in duplicate samples. A second weighed portion of the same fibrated cane was treated in cold running water for ½ hour, and boiled for 5 min., giving after drying to constant weight 10·90 per cent. ; again a further 5 min. boiling, now giving 10·49 per cent. In a further series of determinations, the sugar left in the fibre after varying periods of boiling was ascertained : A portion of the same fibrated cane was treated in cold water for ½ hour, and boiled for 5 mins.; the wet fibre was leached with 1000 c.c. of distilled water for 5 mins., and this water tested for sugar by the thymol reaction, giving 1 part of sugar in 10,000. Again the fibre was boiled for 5 mins., again leached, and again the sugar of the water was estimated with thymol, this time giving 1 in 20,000. Next the same fibre was given 20 minutes' longer boiling, the fibre content now being 9·93 per cent. Again the dried fibre was leached, this time giving 1 in 25,000. Next followed 30 minutes' boiling, this bringing the fibre down to 9·68 per cent., that was after 60 minutes' boiling. All this shows that comparative results can only be got by working with the same method. Therefore the author outlines methods of sampling and " fibrating " which he considers should be followed. For the actual fibre determination, he recommends the procedure described in the Hawaiian " Chemical Control " manual, on page 34.

TEATINI PROCESS.—St. Grzybowski[1] doubts whether in this process of beet juice clarification it is possible to reach the iso-electric point of the greater part of the colloids, since calcium sulphite is immediately formed, besides which this $CaSO_3$ is later adsorbed by the calcium carbonate during the subsequent carbonatation. The yellowish-green colour of juice purified by this process is proof of its insufficient purification, he says. Examination of the condensed water from the 1st and 2nd vessels of the evaporator would probably show an increase of its ammonia content, thus providing another indication of an improperly performed lime defecation.

[1] *Gaz. Cukr.*, 1931, 15 ; through *deut. Zuckerind.*, 1931, 56, No. 33, 863.

The Maxwell-Boulogne PATENT Simplified JUICE SCALE

NOW THE CHEAPEST
STILL THE MOST
ACCURATE
AUTOMATIC SCALE

Extract from certificate received from Java Proefstation Pasoeroean

"—*It is the most accurate weighing machine which exists, it is perfectly mechanical and automatic and needs no supervision. Its construction is so strong that it will, for years, need no repair.*"

The Director of the Java Experiment Station

(Signed)
Dr Ph van Harreveld

59 WORKING IN JAVA

Weighing Raw Juice, Imbibition Water, Syrup, Molasses, and Diluted Filter Mud.

GEORGE FLETCHER & CO., LTD.
DERBY ENGLAND

Manufacturing Results of Natal Sugar Factories for 1930-31 Season.

Following are the weighted averages and total figures for 21 Natal sugar factories of the 1930-31 crop :—

Tons cane crushed	3,575,954
Tons sugar bagged and estimated	372,916
Tons cane per ton sugar	9·59
Time crushing per cent. available time	84·38
Tons of cane per hour actual crushing	52·16
Tons white sugar made	55·076
Tons raw sugar made	212,531
Tons low grade sugar made	113
Sucrose per cent. cane	13·66
Fibre per cent. cane	15·82
Java ratio	76·36
Natal ratio	77·21
Milling loss	9·54
Extraction ratio	0·69
Imbibition per cent. cane	26·62
Sucrose in juice per cent. sucrose in cane	89·78
Sucrose per cent. bagasse	4·20
Moisture per cent. bagasse	50·66
Sucrose per cent. cane lost in manufacture	3·58
Sucrose in sugar per cent. sucrose in cane	74·77
Sucrose in sugar per cent. sucrose in juice	83·80
Available sucrose per cent. sucrose in juice	88·20
Boiling house efficiency	93·87
Sucrose in bagasse per cent. sucrose in cane	11·08
Sucrose in filter cake per cent. sucrose in cane	0·73-2·80
Sucrose in molasses per cent. sucrose in cane	7·68-11·36
Undetermined sucrose per cent. sucrose in cane	1·93-16·18
Sucrose lost in boiling house per cent. sucrose in cane	14·15
Sucrose in total losses per cent. sucrose in cane	25·23
First crusher juice—	
Brix	20·20
Purity (apparent)	88·66
Last pre-imbition juice Brix.	20·06
Last roller mill—	
Brix	7·09
Purity (apparent)	70·79
Purity drop from first crusher	7·91
Mixed juice—	
Brix	15·91
Purity (Clerget)	85·88
Mixed juice—	
Reducing sugar ratio	3·33
Parts SO_2 per million of Brix in sulphited juice,	7530-19736
Purity drop from first crusher	2·72
Clarified juice—	
Brix	16·12
Purity (apparent)	87·64
Reducing sugar ratio	2·76
pH	7·15
Parts SO_2 per million of Brix	506-1425
Filter cake—	
Per cent. sucrose	4·97
Weight per cent. cane	4·97
Syrup—	
Brix	53·71
Purity (apparent)	87·60
Reducing sugar ratio	2·64
pH	6·91
Purity drop from first crusher	1·08
Purity increase from mixed juice	1·73
Parts SO_2 per million of Brix	387-774
First massecuite—	
Brix	91·90
Purity (apparent)	84·72
Purity of run-off	66·06
Cubic ft. per ton of sugar	43·44
Second massecuite—	
Brix	93·55
Purity (apparent)	72·65
Purity of run-off	52·65
Cubic ft. per ton of sugar	39·83
Third massecuite—	
Brix	93·82
Purity (apparent)	64·99
Purity of run-off	44·10
Cubic feet per ton of sugar	50·64
Jelly—	
Brix	90·30
Purity (apparent)	51·77
Purity of run-off	45·86
Final molasses—	
Brix	85·34
Purity (apparent)	45·90
85° Brix per cent. cane	3·14
Polarization of sugars—	
White	99·12
Raw	97·63
Low grade	—
Average of all sugars	97·96
SO_2 in parts per million	20·70

Java Technical Notes.

CONTROL OF BOILER WATER. **P. Honig and J. F. Bogtstra.** *Proefstation voor de Java-Suikerindustrie, Mededeelingen,* 1930.

In different industries it is usual to exercise a more or less complete chemical control over the water used in the boilers; and if this has not yet been done in sugar factories it is not because it is not at least as necessary. So far, this Bulletin says, SAZAVSKY appears to have been the first to examine the demands necessary in sugar-house boiler water control; and it was as the result of his work that the directions for the examination of boiler water, included in the standard methods for the Czecho-slovakian factories, were drawn up.[1] These directions are based on the publications of SPLITTGERBER[2] by whom it was presumed that boiler water must have a certain alkalinity in order that corrosion may be avoided, the limits stated being 0·04 per cent. NaOH, and 0·185 per cent. Na_2CO_3. Then the so-called sodium number is calculated from the proportions of these two compounds, viz., $\frac{Na_2CO_3}{4\cdot5} + NaOH$ in mgrms. per litre, which value should be above 0·01 per cent. It is determined by WARDER's method in which the cooled water is titrated with standard acid, using as indicators, first phenolphthalein, and afterwards methyl orange for the carbonate content. As the extreme limit for the content of total solids one can take 20 grms. per litre, which in fact is so high that it can be found from a density determination, corresponding to 1014 or 3·6° Brix. Following are the determinations now specified by the authors for use in sugar factories in Java for boiler feed waters :—

Determination	Limiting Value	Number of tests to be made
Alkalinity (*pH*)	Higher than 9, preferably > 10	Once in 12 hours per boiler.
Organic matter ($KMnO_4$ figure)	$<$ 2 grms. per litre	Once in 24 hours per boiler.
Insoluble matter	$<$ 0·5 grms. per litre	Once in 3 days per boiler.
Sodium number	Not stated	Once a week for every two boilers.
Total soluble matter	Not stated	Once a week for every two boilers; is closely connected with the sodium number.

Notes on these determinations taken from the analytical methods described by the authors are as follows: The *pH* value is generally determined colorimetrically using thymolphthalein, the colour changes of which are very easy to detect, colourless being 9·5 or lower; light blue, 9·5; blue, 10; and dark blue, 10·5 or higher. The indicator should be made up as a ½ per cent. solution in 75 per cent. alcohol, previously neutralized, using p.p. Solution is effected by triturating the indicator with a little undiluted alcohol in a mortar, the spirit thus saturated with alcohol being poured off from time to time till all is dissolved, the liquid being then made up to volume with the 75 per cent. alcohol. In estimating the permanganate figure, 100 c.c. of the water are acidified with 10 c.c. of H_2SO_4 (1 : 1), heated to boiling; 8 c.c. of N/1 $KMnO_4$ added; and boiled for 10 min., a small funnel being placed in the neck of the flask. After the boiling, 10 c.c. of N/1 oxalic acid are added, and the liquid back-titrated with permanganate. A blank test with distilled water is made at the same time, this result being deducted from the other.

[1] "Anleitung zur Ausführung chemischer Untersuchungen in Zuckerfabriken nach einheitlichen Methoden."

[2] In his monograph—"Der zeitige Stand der Kesselwasserpflege."

Rapidity of Crystal Growth (Crystal Surface of Sugars). P. Honig and W. F. Alewijn. *Proefstation Mededeelingen*, 1930, 44-48.

Sugar crystallizing out is determined by the surface (S) on which it deposits, the time (t), and a certain factor (N), which can be called the specific rate of crystallization, which depends on the temperature, supersaturation, and nature of the solution, its purity, for example. Thus : $dp = SNdt$; N being dp/Sdt; or $dp/dt = NS$, N becoming the specific rate of crystallization, as expressed, for example, in mgrms. of sugar crystallized per min. per sq. metre of crystal surface. Thus for the rate of crystallization at definite supersaturations and different temperatures the following figures are found :—

	Supersaturation. 1·025.	1·050.
N at 20°C.	190	420
N at 40°C.	855	2080

From this the important fact follows that the rate of crystallization is greatly dependent on the temperature, so that if at 65°C. about 10 per cent. requires 10 minutes to crystallize out on already present crystal, then under the same conditions of supersaturation and purity at 45°C. for the same quantity of sugar to crystallize about 50 minutes will be required. This should be taken into consideration in installing a new crystallizing station; while in continuous crystallization parallel-current rather than counter-current cooling should be used

It seems worth while to calculate the crystal growth for a few strikes, in doing which one must know the total crystal surface of the sugar crystals present. Thus, expressing the crystal surface in sq. cms. per grm. of sugar of a definite size of crystal in mm. the proportion for the different sizes of crystals is found to be as follows :—

Fraction	Size of Crystal	Crystal Surface
1	Above 1·65	33
2	1·65—1·17	53
3	1·17—0·83	66
4	0·83—0·59	83
5	0·59—0·30	20
6	0·30—and smaller	170

The volume weight, or grms. per c.c., of the different sizes amounts to : 1st, 0·84 ; 2nd, 0·91 ; 3rd, 0·93 ; 4th, 0·96 ; 5th, 0·95 ; and 6th, 0·88. For the crystal surfaces of the sugars of two Java factories, the following figures for the sq. m. of surface per kg. weight were found : A-sugar of the Goedo factory, 10·4 ; B-sugar of the same factory, 10·5 ; and A-sugar of the Poerwodadi factory, 9·0. These figures show clearly that the smaller the crystal, the greater the surface per unit of weight, which relationship means that during crystallization the smaller crystals will grow more than the larger ones. One therefore sees at once how important it is that false grain must be avoided. Its surface will comprise a very important part of the total, so that in the case of a strike containing much this fine material will take up a great proportion of the sugar crystallizing out. This fine sugar will be thrown out with the molasses. Thus it was found that the molasses spun off an A-massecuite contained per 100 of Brix 3·7 per cent. of fine grain directly after the centrifuging. After 3 hours cooling this was raised to 6·3 per cent.

Statistics of Materials used in Sugar Manufacture during 1930. C. Sijlmans. *Archief, deel III, Mededeelingen*, 1931, No. 25.

Besides the chemical control and fuel control data, statistics are compiled by the Java E.S. on most other matters of any importance appertaining to

cane cultivation and sugar manufacture. Now the quantities of the chemicals and other accessory substances, consumed by the *fabrieks* in that country are tabulated. The most important of these data are here stated separately for the total defecation, sulphitation, and carbonatation factories :—

	Defection	Sulphitation	Carbonatation
Coke (not including that for lime-kilns) :—			
Gas, tons	38·3	118·1	622·1
Foundry, tons	448·6	688·6	484·0
Coke for Lime Kilns :—			
Gas, tons	—	—	15,252·9
Foundry, tons	—	—	8,646·8
Coal, tons	8,298·6	4,338·9	6,294·0
Oils (not including lubricants), tons	2,202·0	10,912·3	2,396·1
Wood, tons	15,316·3	16,632·5	34,055·4
Lime, Caustic :—			
Total tons	5,756·3	15,848·9	—
kg. ton cane	0·8	1·7	—
Limestone, tons	—	—	278,005·6
Ratio : Limestone divided by Coke	—	—	11·9
Sulphur :—			
Total, tons	246·0	8,134·8	1,612·9
kg., ton, cane	0·07	0·87	0·19
Kieselguhr (filter-aid), tons	6	207	—
Hydrosulphite, tons	—	1·065	1·015
Phosphoric clarifying paste, tons	21·5	133·5	0·919
Filter-press cloth :—			
Thick, sq. m.	98,295.0	125,829	198,123
Thick, sq. m., 100 tons cane	1·31	1·42	2·40
Thin, sq. m.	37,770	55,979	85,069
Thin, sq. m. 100 tons cane	1·33	1·40	1·61
Evaporator Cleaning :—			
Caustic Soda, tons	188·6	319·7	161·9
Soda Ash, tons	1·90	—	0·6
Amm. Fluoride, tons	2·9	4·6	0·8
Common salt, tons	—	3·4	—
Muriatic Acid, tons	0·3	4·3	10·523
Preparations as Algaloid, Boiler Enamel, etc., etc., tons	0·6	0·9	0·150
Blues, tons	—	3·1	2·4
Disinfectants ; as Formalin, Carbolic, etc.	These are not totalled ; average amount per factory, about 100-200 kg.		
Alkalizing materials :—			
Caustic soda, tons	10·6	46·0	24·3
Soda ash, tons	18·7	60·0	42·3
Boiler disincrustants, as "Algor," "Boiler Enamel," "Taucheriet," etc., tons	2·7	5·8	2·215
Lubricants :—			
Oils in litres	534,599	677,781	720,369
Fats in tons	20·5	28·3	25·7
Paints and Varnishes :—			
Made in Java, tons	35·6	52·5	34·1
Imported, tons	45·9	67·5	33·6
Insulating Materials for Pipe Lines, etc. :—			
Magnesia, tons	5·8	32·1	43·2
Kieselguhr, tons	71·8	59·0	49·8
Asbestos, tons	0·7	3·7	1·2

Estimation of the Extent of Boiler Corrosion. **J. Eigenhuis.** *Archief*, 1931, **39**, I. 25-26, 716-727.

In order to estimate the amount of corrosion occurring in boilers, two iron plates, ⅛ in. thick, and 1 sq. dm. (16 sq. in.), were immovably clamped to the fire-tubes, one in front, and the other at the rear. Both test-plates had previously been weighed. At the end of the campaign, they were removed, rinsed with clean water, dried, and re-weighed, after which the adhering rust and dirt were carefully scraped off, and the test-plates once again weighed. In this way the increase due to rust or scaling of the test-plates and also the decrease in the weight of the plates due to corrosion was determined. By taking the average of figures found for all the test-plates of the boiler installation, a result could be obtained which probably fairly represented what was happening to the boiler-plate itself. All the test-plates were made of the same sheet-iron, and though the composition of such metal may not have been identical with that of the actual boiler-plate, probably no very great error could arise in this way. Such experiments were instituted in a good number of defecation, sulphitation, and carbonatation factories in Java, and the results thus obtained are tabulated in the original article. On averaging up all the results, it was found that only in 4 of the 71 boilers examined was there an increase in the weight of the test-plates, this being due of course mainly to the deposition of lime salts, and to some extent to rusting.

On the other hand, corrosion as shown by a decrease of weight was almost general; and what is remarkable is that it was found to be most in the boilers of defecation factories, next in sulphitation, and least in carbonatation, being in the proportion of 3·9 : 2·0 : 1·0 respectively. One would have expected either of the latter two methods of clarification to have produced a more corrosive water than results from the defecation process. All the factories had treated their feed-waters to a certain *pH* with soda, and in varying amount; but this treatment did not seem to make any difference in lessening the amount of corrosion. In fact there did not appear to be the slightest connexion between the *pH* of the boiler-waters and the amount of corrosion, the reason of this probably being that the effect exerted by the oxygen of the feed-water is not expressed by the *pH*, nor is there other easy means of so doing. Another factor might have played a rôle, namely the presence of some ammonia, which had imparted a temporary alkalinity to the feed-water, causing the soda addition to be too low, so that on its volatilization with the steam the *pH* had fallen. But on the whole, the amount of corrosion estimated was slight after all. Even taking the maximum figures, the test-plates would have diminished in thickness only 3·7 mm. (nearly 5/32 in.) in 30 years, though of course the possibility of danger to be considered is local pitting, which is due less to chemical than to mechanical effects, such as circulation currents or heat transmission.

Specific Heat of Sugar Factory Products. **W. W. Janovsky and P. A. Archangelsky.** *Jur. Sakh. Prom.*, 1929, No. 3, 511; through *Archief*, 1931, **38**, deel II, No. 34. 785-797.

Results obtained by these authors for the specific heat of beet sugar factory producers, obtained in the Carbohydrate Laboratory of the Technological Institute, Leningrad, may be summarized as follows: (1) That the specific heat of beet factory juices and syrups is lower than that of pure solutions at the same temperature and concentration. (2) That the specific heat of beet factory juices and syrups at a given temperature is dependent on the concentration as well as on the purity, decreasing with increasing con-

centration and with decreasing purity, the relationships being represented by straight lines. (3) That the specific heat of beet sugar factory solutions of a certain concentration and purity varies according to the temperature, the relationship being represented by a straight line. (4) That the dependence of the specific heat of beet factory solutions obtained in the working of sound roots upon concentration, purity, and temperature can for practical purposes sufficiently accurately be expressed by the formula :—

$$C_t = 1 - [0{\cdot}6 - 0{\cdot}0018t + 0{\cdot}0011\,(100 - P)\,\frac{Bx}{100} \ldots (I)$$

in which P is the true purity. (5) That the relationship between the specific heat of sugar crystals and temperature is represented graphically by a straight line, and can be expressed by the formula :—

$$C_t = 0{\cdot}2775 + 0{\cdot}00085t \ldots\ldots\ldots\ldots (II)$$

(6) That the specific heat of massecuite can be calculated with sufficient accuracy for practical purposes by the following formula :—

$$C_t = \frac{P}{100} \times C^1 + \frac{100 - p}{100}\,C^{11} \ldots\ldots\ldots (III)$$

in which P = crystal per cent. massecuite ; C^1 = specific heat of the crystal sugar at t°C. calculated according to the (II) formula ; and C^{11} = the specific heat of the mother-syrup at t°C. calculated according to the (I) formula. (7) That the specific heat of the sugar factory solutions as obtained from altered roots is higher than that obtained from normal factory solutions, and to an extent depending on the content in organic non-sugars in the solution. Some of the actual results which were obtained for the specific heat of juices and syrups (not averaged) are as follows :—

Brix	Purity	Temp.	Sp. Ht.	Brix	Purity	Tem.	Sp. Ht.
17·7	88·5	20·6	0·8934	15·0	79·6	51·1	0·9172
14·5	93·4	,,	0·9126	40·0	62·8	,,	0·7808
40·0	94·3	,,	0·7699	52·0	51·8	,,	0·7206
65·0	94·3	,,	0·6258	15·0	83·2	,,	0·9176
15·0	83·2	,,	0·9091	14·5	93·4	81·1	0·9396
65·0	83·2	,,	0·6224	40·0	74·3	,,	0·8225
14·5	93·4	51·1	0·9220	65·0	94·3	,,	0·6967
40·0	94·3	,,	0·7992	75·5	83·2	,,	0·6391
65·0	94·3	,,	0·6658	15·0	62·8	,,	0·9278
75·5	83·2	,,	0·6054	40·0	51·8	,,	0·9311

[A note by the Editor of the *Archief*, TH. J. D. ERLEE, says that these specific heat determinations of the Russian investigators (always difficult to perform with accuracy, as one may gather by comparing the results of determinations by different workers, on other liquids, say on water), can be regarded as satisfactory. It can be concluded, he remarks, that the specific heat values calculated by means of the formulae of JANOVSKY and ARCHANGELSKY will compare well with those of the workers. Though these investigations on specific heat relate to beet factory products, it is hardly to be expected that the values given would differ much from those to be found for cane factory products.]

WOOD PRESERVATION.—An advertisement in an American chemical periodical proclaims the value of zinc chloride for this purpose. Wood treated with it is said to be proof against rot, secure against termites, and resistant to fire. It is similar in colour to untreated wood, and is readily paintable. The treatment is said to be permanent.

Abstracts of the International Society of Sugar Cane Technologists.

Under the scheme initiated by the I.S.S.C.T. a collection of abstracts of papers on agricultural and technical subjects is prepared monthly. A selection from these "Sugar Abstracts" has been made by us from the material last issued, and appears below :—

Cane Sugar Manufacture.

Decomposition of Sucrose and Glucose in Low Grade Massecuites. **J. Gomeri.** *Philippine Agriculturist*, 1931, **20**, No. 3, 199-216.

Some decomposition of sucrose was observed in all the 29 crystallizers of a Philippine sugar factory. In some cases as much as 2 per cent. of sucrose per 100 solids was lost within 30 to 50 hours after the massecuite was dropped into the crystallizer ; in other cases, massecuites held in the crystallizers for 75 to 90 hours showed sucrose losses of only 0·12 to 0·45 per cent. These losses were not found to have any relation to the percentage contents of either total ash or calcium oxide. The cause of this variable behaviour of the massecuites must therefore be sought elsewhere. Antecedent conditions in the vacuum pans may have something to do with it. For example, previous investigators have shown that when massecuites have been boiled at low temperatures there is a smaller loss of sucrose than where the massecuites have been boiled at high temperatures.

Review of the Principal Formulae for determining Recoverable Sugar from the Sugar Cane. **V. Olivier.** *Rev. Agricole Maurice*, May-June, 1931, No. 57, 95-104.

The author is led to conclude that the formula of Winter and Carp, though interesting, cannot be applied as a whole in Mauritius. This formula had its origin in Java ; Mauritian molasses, though exhausted, has a higher purity than Java molasses because of a smaller content of reducing sugars. The author consequently prefers the formula of Deerr, which has the advantage of having three independent variables and gives a figure sufficiently accurate for determining the efficiency factor of the sugar factory.

Beet Sugar Manufacture.

Influence of Suspended Particles on the Boiling and Concentration of Thin Juice. **J. Hamous.** *Zeitsch. Zuckerind. Czechoslov., Rep.* 1930-31, **55**, No. 51, 681-682.

By laboratory investigations Stanek and Pavlas have shown that a much greater amount of lime remains in suspension, that is less is deposited as incrustation when unfiltered carbonatated juice is concentrated than when the same juice is filtered before evaporation. They also recommended addition of 0·01 per cent. of arragonite to the juice as a further aid in this direction. In the present research the author sent the settled but unfiltered clear juice of the first carbonatation through the juice-heaters to the second carbonatators. The result was a considerable reduction in the incrustation of the juice-heaters, from which it appears that filtration of the first carbonatation juice can be dispensed with.

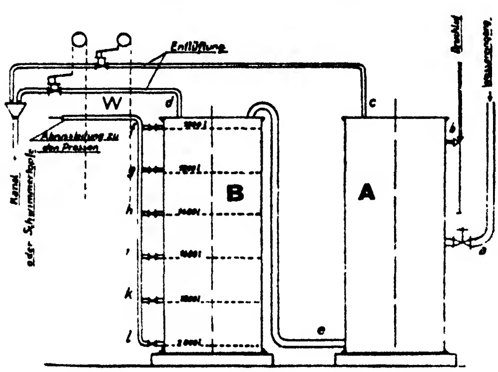
Protecting Stored Sugar against Hydroscopic Moisture. **P. Kuhle.** *Deutsche Zuckerind.*, 1931, **56**, No. 34, 879-881.

Raw beet sugar that has been well dried seldom shows any tendency to absorb moisture in the warehouse during the winter months ; weather conditions in the spring are much more likely to result in moist sugar with consequent loss, due to inversion and action of micro-organisms. Many

authorities advise that the air in sugar warehouses be controlled with the view of not allowing the relative humidity to exceed 60 per cent. This is excellent advice, but it should be borne in mind that humidity changes rapidly with the temperature and temperature changes are usually rapid in the spring, with the result that a relative humidity of 60 at 20°C. in the daytime becomes 90 at 10°C. during the night. It will be much safer to set 50 as the upper limit of humidity ; the humidity of the air of the warehouse should be controlled by a hygrometer and a heating arrangement provided for maintaining the humidity at that figure.

A DEVICE FOR SWEETENING-OFF FILTER-PRESSES. **K. Weschke.** *Cent. Zuckerind.*, 1931, **39**, No. 35, 890.

An arrangement for sweetening out filter-presses with regulated amounts of water consists of two tanks each about 6½ ft. tall. The operation is as follows : the valves on pipe lines *c* and *d* being open, both tanks are filled with water from the water line, *a*. All three valves are then closed and compressed air is admitted into *A* through *b*. Up the side of *B* in a vertical line are a series of outlets, *f* to *l*, spaced so as to admit from 100 up to 1000 litres of water, as desired, from *B* through pipe line *W* to the filter-press, from which the juice previously has been displaced by means of compressed air. The compressed air first drives through the press an amount of water corresponding to the amount in *A*, and then a pre-determined amount from *B*, according to which of the valves *f* to *l* is open. The air then automatically follows the water through the press. By providing suitable floats, the valves on *C* and *D* may be governed automatically. The filter press is satisfactorily sweetened out by this arrangement, and excessive dilution of the juice is avoided. The usual wash-water pump may be dispensed with or held in reserve.



ELECTRIC DRIVE OF SUGAR CENTRIFUGALS. **K. Becker and O Schroter.** *Centr. Zuckerind*, 1931, **39**, Nos. 33-35, 850-852 ; 866-869 ; 888:890.

In this paper, with numerous diagrams, the authors discuss various forms of electric drives for sugar centrifugals. A number of systems are considered, with special reference to a special double squirrel-cage rotor type which can handle 20 charges a minute, made by the Bergmann-Electricitats-werken.

STUDIES ON FILTRATION. **L. Dostal.** *Zeitsch. Zuckerind. Czechoslov., Rep.* 1931-32, **56**, No. 3, 25-31.

As a means of studying the factors that influence the filtrability of limed juice the author set up two filter presses, the valves of which were so adjusted that when the presses were closed and put under the pressure of clean water they each delivered the same quantity of water. By the use of this method the author has found that, in general, filtration is most rapid when the limed juice is carbonatated at a relatively high pressure (1·6 atm.) and when the temperature of carbonatation is between 70 and 85°C.

Mirrlees'

SUGAR FACTORY MACHINERY.

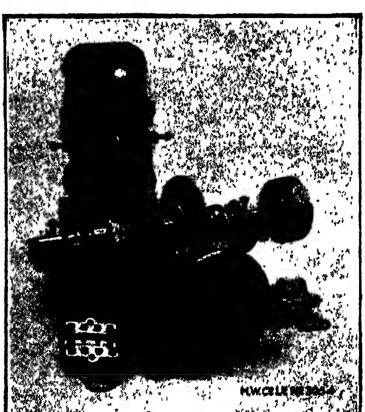
Extract from an Article in the September issue of "Sugar News," by E. Valencia.

PUMPS

The piston pump is being displaced by centrifugal and rotary pumps in a modern factory as it is more troublesome and repair costs are higher. However, for pumping massecuite the piston pump is holding its own.

For extracting condensate and syrup from evaporators the ordinary centrifugal pump gives trouble unless the condensate flows to the pump by gravity. But there is placed in the market a centrifugal pump which gives no trouble due to the fact that air leakage at the glands is avoided. This pump consist of two single sided impellers working in parallel and placed with the inlets facing each other, one on each side of the suction of the chamber which is in direct connection with the pump suction in such a way that the stuffing box is on the discharge side of the pump. It draws liquid against high vacuum.

— GENERATING UNIT



The "Mirrlees" Patent EXTRACTION PUMP referred to in the above Article.

The MIRRLEES WATSON COMPANY LIMITED

ENGINEERS, SCOTLAND STREET, GLASGOW.

London Office - Mirrlees House, 7, Grosvenor Gdns., S.W.1.

0.58

TREATING REFINERY PRODUCTS WITH THE LIME SALTS OF PHOSPHORIC AND SULPHUROUS ACIDS. **K. K. Liubitzkii.** *Naukobo Zapiski*, 1931, **13**, No. 1, 149-175.

By treating green syrups and syrups from second sugars with lime and phosphoric acid a decolorizing effect up to 35 per cent. was obtained. The following conditions were found to be the most suitable: amount of lime taken from green syrup, 0·5 per cent. CaO on weight of the sugar ; for second syrups, 1 per cent., with the ratio of CaO : H_3PO_4 as 1 : 1·137 ; time for treatment 5 to 10 minutes at 80°C. The decolorizing effect increases as the density of the solutions. The best results from treating the same products with lime and sulphurous acid gas were obtained as follows : a current of sulphurous acid gas is passed into the solution, warmed to 60-65°, and small portions of milk-of-lime added up to 0·5 per cent. of CaO on weight of sugar in green syrups, 2·0 per cent. in the case of second syrups, the reaction being maintained slightly on the acid side (about *pH* 6·5). The sulphur treatment being finished the solution is filtered, treated with milk-of-lime to bring the reaction to about *pH* 7·2, heated to 80°C., and again filtered with addition of 0·25 per cent. of kieselguhr. Under these conditions the decolorizing effect reaches 50 per cent.

EVALUATION OF DECOLORIZING CARBONS FOR USE IN THE SUGAR INDUSTRY. **M. Garino.** *l'Ind. Sacc. Italiana*, 1931, **24**, No. 8, 339-341.

It is necessary to distinguish between the activity of the carbon as a decolorizing agent and its total adsorptive power, which latter is determined as follows : 50 grms. of molasses from any source are weighed out, diluted to 500 c.c. filtered, and the gravity and purity of the filtrate determined ; 200 c.c. of the molasses are placed in a 500 c.c. beaker and heated to 90-98°C. on a water-bath. A quantity of the carbon corresponding to 2 per cent. of the non-sugar of the solution is added, and heating is continued for 25 minutes with frequent stirring. The carbon is filtered off on a previously weighed filter-paper and washed with hot water dried to constant weight at 100-150°C., and the weight of carbon plus adsorbed solids determined.

The total adsorbing power may vary from 1·42 (bonechar) to 38·2 grms. of substance per 100 grms. of carbon. For the determination of the decolorizing power, the author prefers to use a solution of calcium apoglucinate.

AN APPRECIATION OF THE PIED-DE-CUITE METHOD OF SUGAR BOILING. *Centr. Zuckerind.*, 1931, **39**, No. 38, 956-958.

An extensive discussion is given of the use of pied-de-cuite in sugar boiling, which is standard practice in most cane sugar countries, but is little understood in Europe. The pied-de-cuite method is shown to have several advantages, especially in boiling low grades ; there is less danger of false grain, work at the centrifugals goes more easily, and the purity of the final molasses will be lower because there will be less necessity for diluting poor massecuites to lower their viscosities.

REMOVING SAND FROM BEET WASH-WATERS. **E. Thielepape.** *Deutsch. Zuckerind.*, 1931, **56**, No. 35, 899-901.

A description is given of three installations at different beet sugar factories for removing sand from the beet wash-water. The arrangement consists of a wheel of large diameter (up to 24 ft.) with cross arms bearing scoops that scrape the bottom of the canal and elevate the sand to a point from which it can be hauled away. The most effective of these installations, where the wheel works countercurrent to the water, recovers 7·3 per cent. sand on weight of

beets; the other two recover 2·4 and 3·3 per cent. The earthy matter not removed as sand is allowed to settle and can then be pumped to a considerable distance in the form of a sludge at relatively small expense. The recovered sand is suitable for use as washed sand in masonry and concrete. The output at one factory was 7,130 metric tons of washed sand from 105,000 tons of beets.

POROSITY OF CARBONATATION PRESS-CAKE. **J. Dedek and L. Dostal.** *Zeitsch. Zuckerind. Czech. Rep.*, 1930-31, **55**, 671-681.

The porosity of dry carbonatation press-cake from different types of filter presses (Kroog, Sweetland, Kelly) was determined by measuring the air contained in the press-cake that had been dried at 90 to 100°C. The porosity as thus determined varied from about 52 to 71·1 per cent., being generally inversely proportional to the dry substance content. On the other hand, the porosity of the cake (determined by this method) is the greater, the smaller the amount of lime used in purifying the juice; the more lime, the less porous the cake. This appears to be in contradiction to the well known fact that increasing the amount of lime causes easier filtration of the carbonatation muds. The authors offer various explanations to account for this seeming contradiction.

SUGAR CANE AGRICULTURE.

SOILS AND FERTILIZERS FOR SUGAR CANE. **I. A. Colon.** *El Mundo Azucarero*, 1931, **19**, No. 1, 13-16.

Recent experience with fertilizers in Porto Rico shows that applications of ammonia up to 120 lbs. per acre give profitable returns; the effects of applications of potash and phosphoric acid are variable, but it seems that phosphoric acid in excess of 60 lbs. may be harmful. The best all round mixture seems to be 80 lbs. ammonia, 30 lbs. phosphoric acid, and 20 lbs. of potash per acre.

ACID, ALKALI, AND SALTY SOILS IN SUGAR CANE CULTIVATION. **O. W. Willcox.** *El Mundo Azucarero*, 1931, **19**, No. 2, 41-45.

A summary of present knowledge of the relation of soil reaction and salt content to the yield and physiology of the sugar cane. Most varieties of this crop prefer a soil where the reaction is about *pH* 7·0. Acid soils are usually poor in phosphoric acid, so that the liming of soils often involves the question of supplying phosphates. The effect of salt in a cane soil is very largely governed by moisture conditions; a given quantity of salt, figured as a per cent. by weight on 1 lb. of soil, may be totally harmless if the soil has a high moisture content, but may become very toxic as the soil dries out. In testing a soil for salt, consideration should therefore be given to the possibility that the amount present will be likely to reach a dangerous concentration in the dry season.

CONTROL OF THE SUGAR CANE ROOT BORER. **R. W. E. Tucker.** *Report Dept. Sci. Agr., Barbados*, 1930-31, 94-95.

Eighteen thousand eggs of *Diaprepes abreviatus* Linn., the sugar cane root borer, were examined for parasitism, but none was found, and there was very slight evidence of attack by fungi or predators. There does not appear to be any natural check on this parasite in Barbados other than toads and lizards, though it is intended to import the egg parasite, *Tetrastichus haitensis*, from Haiti. The only practicable means of controlling this pest is systematic

collection of the beetles throughout the entire year, and the success of this method has been demonstrated on several plantations. On Lancaster plantation, 1,315,200 root borer beetles were collected in 12 months at a cost of $770 and 277,000 brown hard-backs (*Phytalus smithii*) at a cost of $83. Collectors were paid at the rate of 40 cents per pint of beetles (800 to a pint). The increased yield of first and second ratoons clearly showed a profit. Diaprepes is more prevalent in the drier than in the wetter districts.

Beet Factory Technical Notes.

Lime Economy.—In this contribution Dr. W. Beyte[1] states that at Mühlberg a. Elbe he has worked since the last year of the war with a lime-economy process with marked success. It differs from that described by Dr. Troje,[2] and from that of Dr. Naehring,[3] in that neither scums nor milk-of-lime is added to the raw juice, but some of the defecated juice. As the raw juice flows from the two juice measuring tanks into the large collecting tank below, it meets a definite amount of previously defecated juice. This alkaline mixed juice is pumped through heaters to the dry defecation station, and from thence to the first carbonatation tanks. In the pipe-line connecting the two last, there is a valve adjustable so that part of the dry defecated juice can be returned to the raw juice collecting tank, as mentioned. Of the total volume of dry defecated juice, 12-17 per cent. is returned in this way, the exact amount being varied according to the acidity and the nature of the raw juice. Last year it was such that the mixed juice showed from 0·08 to 0·12 per cent. CaO by titration with N/28 sulphuric acid or a *pH* from 10·7 to 10·9. At this alkalinity a dirty-white, flocculent, precipitate settles quickly, leaving the supernatent juice quite clear with a yellowish green colour. A temperature of 60-70°C. appears to be the most suitable, and the CaO addition amounts to 1·3 per cent. of the roots. This gives such a good clarification that sulphuring the juices becomes unnecessary. Irregularities in carbonatation and filtration are no longer known in this factory, and the scum-presses can be sweetened-off to about 0·5 per cent. sugar and still lower if time permits. An average rendement of 92·5 is obtained and a sugar constantly of Type 5 is produced.

Divided Defecation.—This is another paper on the important new development in the liming of juice in the beet factory; whereby, by dividing the dose, the total lime addition can be reduced. It is by Dr. O. Spengler, Director of the Berlin Institute for the Sugar Industry.[4] He first says that factories are known in which the lime used is only about 1·1 per cent. of the roots, and in which a perfectly satisfactory raw sugar is made. In others up to 2·5 per cent. may be added. Such differences can hardly be due to the varying nature of the juice, but are certainly to be traced to the method of conducting defecation, some being known to divide the dose. He then comments on the results obtained by Dr. E. Naehring.[5] In the factory concerned, viz., at Stöbnitz, the colour of the raw sugars ran evenly at a little over 4, but Dr. Spengler who had been examining these sugars for their colour noticed one day that their valuation suddenly rose to Type 5 at

1 *Deut. Zuckerind.*, 1931, **56**, No. 24, 660. 2 *Ibid.*, 1930, **55**, No. 20, 549.
3 *Ibid.*, 1930, **55**, No. 51, 1353; also *Centr. Zuckerind.*, 1931, **39**, No. 31, 805-807.
4 *I.S.J.*, 1931, 552.
5 *Deut. Zuckerind.*, 1930, **55**, No. 51, 1353; *Centr. Zuckerind.*, 1931, **39**, No. 31, 805-807.

least. On investigation it was found that the reason was due to the division of the dose of lime. Some 40 litres (say 9 gallons) of milk-of-lime were added to each measuring tank before filling it up; the juice thus pre-defecated being sent through heaters; subsided quickly; defecated as usual with the remainder of the dose; and carbonatated off. It was in fact found that the usual dose could be reduced, so that instead of 1·75 per cent. it could be lowered to 1·25, or even at times to 1·0 per cent., while obtaining better results, in respect of sugar yield and sugar colour. Besides, filtration was improved. Another advantage claimed was that in pre-defecation the juice colours during evaporation only a little, namely about 0·4° Stammer, whereas when adding all the lime at one time the increase of colour after concentration might have been about 6° Stammer. Other points from this paper by Dr. SPENGLER are that "the Teatini process is indeed a typical lime-saving process"; that it is unsuitable for German conditions: but that it has nevertheless brought the problem of lime economy into prominence.

Teatini Process.—Dr. JIRI VONDRAK[1] has continued his laboratory investigations on the value of this process, as compared with fractional liming.[2] He carried out several series of experiments. In one of these, he studied only the quantity of lime employed for defecation, and its mode of addition. His tabulated results showed that a juice defecated with 1 per cent. of lime added in one dose filters badly, whereas the same juice brought to 85°C., and defecated in two stages, first with 0·1 per cent. of lime, and a few minutes after with 0·9 per cent. of lime, filters much better. Pre-defecation in the cold (at 20°C.) does not give good results. He further noticed that juice defecated with 2 per cent. of lime is clearer, and is less apt to re-colour during its subsequent treatment. Juice defecated in the cold re-colours in a very pronounced manner; and there can be no doubt that pre-defecation, in which this first dose is made to the heated juice, is now an improved juice purification technique. Experiments were carried out exactly to the Teatini prescription; but only in one instance did this procedure lead to a more favourable filtration than simple fractional liming. In two cases, in fact, it filtered rather worse. According to the author, there is a type of juice which does not show a more favourable filtration after treatment according to the Teatini process than juice which has undergone a simple fractional defecation; whereas there is another type of juice which behaves better with the Teatini process, so that after it there is a distinct improvement in filtration. It is, therefore, of importance, he concludes, to differentiate between the two types, and to ascertain which predominates during the campaign.

Syrup as Lubricant.—Dipl.-Ing. WOLF VOITLÄNDER[3] has just published a study entitled "A new Apparatus for testing the Lubricating Power of Oils," in which it was shown that sugar syrup has remarkable lubricating properties. After reviewing methods of oil testing in general, the author pointed out that, apart from their chemical qualities, as freedom from acidity, lubricants have been judged until a few years back only according to their viscosities. But the fact that lubricants of the same viscosity may in practice behave quite differently has given rise to the search for other important factors by the construction of oil testing machines. All the machines so far designed for the purpose show the practical impossibility of providing absolutely even frictional surfaces, and they therefore give results which cannot directly be applied to practice. Dr. VOITLÄNDER has, however, now con-

[1] *Zeitsch. Zuckerind. Czechoslov.*, 1931, **56**, No. 6, 57-66. [2] *I.S.J.*, 1931, 552.
[3] *Deut. Zuckerind.*, 1931, **56**, No. 45, 1122-1123.

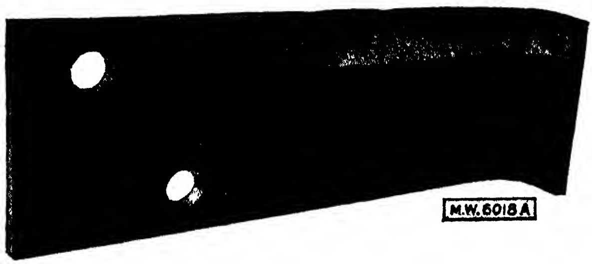
structed a new apparatus which according to numerous tests is very well suited for judging the quality of lubricants in industry. It is hardly of interest here to describe this apparatus, and some of the results only will be mentioned. Sugar syrup having a density of 1335 corresponding to 67·5° Brix was compared with raw and refined rape oil and with well-known types of mineral oils. All these lubricants were examined by means of the new apparatus at the same viscosity by varying the temperature. It is a surprising fact that in every series of experiments the sugar syrup exhibited the lowest frictional results, thus surpassing in lubricating power the best oils, which fact, established in the oil testing apparatus, was confirmed by practical tests. Its technical utilization in this way for this purpose is, of course, impossible, owing to several undesirable properties, as rapid evaporation, rusting action on the lubricating surfaces, susceptibility to decomposition, etc. It is, nevertheless, of interest to have discovered in this way that sugar syrup possesses such remarkable lubricating qualities, unsuspected until now.

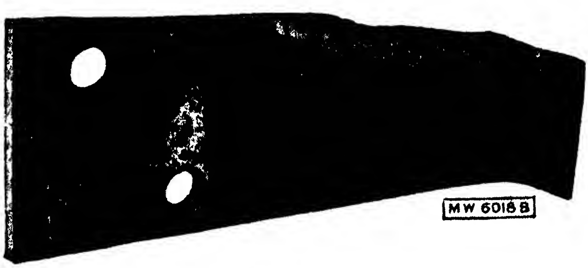
Molasses Colloids.— K. SMOLENSKI, of the Warsaw Station,[1] has carried out a very thorough investigation on this subject, for details of which reference should be made to his original memoir. On studying the surface tension of beet molasses, the highest values were obtained with neutral solutions, the figures falling away with increasing acidity and with increasing alkalinity. At any given Brix degree the viscosity of beet molasses solutions was not greater than the corresponding pure sugar solutions. At alkalinities above 11 *pH*, the viscosity increased distinctly with both molasses and sugar solutions. Regarding colour, this gradually increased from 10 to 4·0 *pH*. Then came the dialysis experiments forming the most important part of the research. Using the Gutbier apparatus, the colloids separated after 160 hours at 60-70°C. were found to contain 0·27 per cent. dry substance without ash, calculated on the molasses, this being called Fraction *A*. The solution remaining was dialyzed for another 140 hours at 40-50°C., giving after filtration Fraction *B* of 0·042 per cent. dry substance on the same basis. The filtrate was evaporated in vacuum at 30-40°C., giving Fraction *C* with 0·59 per cent. of organic colloids. All three fractions were extracted with ether, alcohol and benzene. On taking up Fraction *A* in dilute sodium hydroxide, in which it partly dissolved, and precipitating with HCl, Substance A_3, similar to STANEK'S "fuscazinic acid," and mainly containing irreversible colloids, was obtained. Its simplest formula corresponded to $C_9H_{10}NO_3$. That portion of Fraction *C* which after extraction with ether, alcohol and benzene had dissolved in water was filtered off and treated with HCl to 3·0 *pH*, the precipitate obtained giving Substance C_3; while the solution from it after neutralizing was dialyzed further, this after concentration and drying giving Substance C_4. It was proved that besides a small amount of higher fatty acids two groups of colloids were present: (1) irreversible, insoluble in water, characterized by an acid or amphoteric character, a very intense dark-brown colour, and a high content in nitrogen; and (2) reversible, soluble in water, characterized by their neutral character, light-brown colour, and low content in nitrogen, in which group large amounts of araban and probably also dextran were included. The colour of the A_3 colloids was found to be 150-200 times greater than those of the dry substance of the original molasses. Solutions of both colloids A_3 and C_4 were decolorized very considerably (87·4 and 84·5 per cent.) by carbonatation using 1 per cent. CaO.

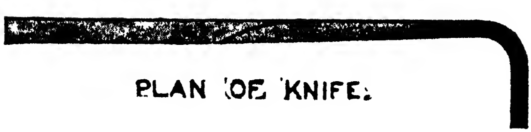
1 *Gaz. Cukr.*, 1931, 18, 585-545; through *Deut. Zuckerind.*, 1931, 56, No. 44, 1106-1107.

A New Design of Cane Knives.

Revolving cane knives, which are now indispensable in a modern sugar factory, are subject to wear at the tips. This wear reduces the effective diameter of a set of knives (i.e. the diameter over the tips) and allows an increasing quantity of uncut cane to pass between the knives and the carrier apron. When this occurs present practice is to lower the knives or raise the carrier apron. To reduce the effect of wear and to improve the shredding and cutting done by their knives, the Mirrlees Watson Co. Ltd., of Glasgow, have designed and patented a renewable knife blade which has a greater body of metal at the tip to resist wear and more effectively cut the cane over the whole width of the cane carrier.







PLAN OF KNIFE.

The patented feature of the new design is that in place of the tip being curved back and sharpened in the usual manner it is made longer, the extension being made the full width of the blade. The extended portion is bent over at right angles to the main body of the blade as illustrated. The bent or "hooked" portion of the blade is set so that the leading or cutting edge describes the greatest diameter, preventing the following edge from dragging when the canes are being cut. The cutting edge may be tipped with a hard cutting alloy, such as Stellite, Stoodite or Tube Borium.

A set of these knives has been on trial for part of the last milling season, and the report on this trial is as follows :—

> " The trial set of hooked knives was a decided success. They prepare the cane much better than the older type, and go a long way towards rendering two-roller crushers and shredders redundant. The bottom crusher roller now floods with juice, and had to be opened to such an extent (to pass the feed) that it did little or no work. We shall juice-groove it next crop."

These knives are interchangeable with all existing Mirrlees Watson Co.'s cane knife installations, and can be supplied for installations of heavy duty knives of other manufacturers on receipt of particulars of the existing hubs and blades.

British Patent No. 356,602 has been granted for the invention, and patents have been applied for in the principal cane sugar producing countries.

A New Design of Cane Knives.

After a prolonged series of experiments with various cutting materials the Mirrlees Watson Co. now supply knives of a high quality shock-resisting Sheffield steel which have proved most satisfactory in service. An Engineer using these knives in Peru writes :—

> "I have to give you an interesting fact. About three months ago a piece of cast-iron more than 60 lb. in weight fell into the carrier and reached the knives. These struck the iron several strong blows, marked it deeply and several small pieces were knocked off, but the knives themselves sustained very little damage. This, I believe, is the best proof of the material which you can have when experimenting with knives. We are preserving this piece of iron as a curiosity to show to our friends here."

Correspondence.

EGYPT AS A MARKET FOR SUGAR MACHINERY.

To the Editor, "The International Sugar Journal."

Sir,—In comparison with the big sugar producing countries, Egypt is of small importance as a purchaser of Sugar Machinery but, in these years of stress, it seems hard to account for the apparent indifference of British sugar machinery manufacturers to the possibilities of this market. Since the war, sugar machinery of a value running high in six figures has been imported into Egypt, a negligible portion of which has come from British producers, being mostly spare parts or machinery that could not be procured elsewhere. The balance has gone to Continental manufacturers. The staff of the Egyptian sugar factories being mostly French, a large proportion of orders went naturally to French firms, but there has been no systematic discrimination against firms belonging to other countries, and important orders have been placed with Dutch and Belgian concerns.

However, and this is the point I want to make, these firms took a great amount of trouble to secure their orders, sending over to Egypt every season competent representatives, and even the managers of two important concerns found it worth their while to spend many weeks in Egypt several winters running. How is it that with one exception no British firm has taken the same trouble ? It seems incredible that they could not have been easily informed of the industrial needs of a country so closely allied to the Empire and in which there are no tariff barriers to prevent them from competing on equal terms with foreign rivals. Have they as many orders as they can deal with or are their costs hopelessly high ? If either is the case—but there is good reason to think it is not—the recent fall in the value of the pound ought to help them a great deal.

Faithfully yours,

V. PENIAKOFF.

Sugar Refinery,
Hawamdieh,
Egypt.

New Guinea.—Sangara Sugar Estates, Ltd., with a proposed paid up capital of £500,000, has been formed for the purpose of promoting sugar production in Papua, where labour conditions are stated to be lower than in any other country, excepting only Java. Great Britain and Canada would be the markets for the sugar made, if the project were successful.

Brevities.

Alcohol Locomotives.—"Regarding the selection of locomotives for operation on mountain lines or steep gradients, I do not hesitate to advocate and recommend to you the admirable qualities of the internal combustion locomotive which when running on alcohol fuel, operated at one quarter the cost of steam locomotives and is able to develop 20 per cent. more tractive power due to the steadiness of the pull through its well-designed gearing ratio and its ease of manipulation on heavy grades."[1]

Mirrlees Watson Factories for India.—We understand that the Mirrlees Watson Co., Ltd., have four sugar factories on order at the moment for India. One is for a firm to whom they had previously supplied two factories; another is a duplicate of a factory supplied by them in 1927 which has operated so successfully that the present order is the result; and two are 400-ton factories which have been ordered by Messrs. Birla Brothers and are being both designed and constructed by the Mirrlees Watson Co., Ltd., at Glasgow.

C.S.R. Co.—The Colonial Sugar Refining Co.. of Australia, has eight factories, six refineries, and one distillery, employing in all in these about 100 trained chemists. These are recruited from the best pupils of the State schools. Each year two of the best men are selected, and given a University training. Further, the Company has always adopted the policy of having at least one technologist or agriculturist travelling the cane sugar-producing countries of the world collecting information, thus keeping abreast of progress.[2] It looks to its large research staff for advance and progress.

Testing Cane Ripeness.—By progressive tests with the hand refractometer the gradual increase in the dry substance content of the juice of the growing cane can easily be observed, and an estimate of the maturity of the plant thus obtained. The method is both simple and rapid, the procedure being: Collect a few drops of juice from the stalk, using a special tapping tool; apply some of the juice to the prism of the refractometer; hold the instrument against the light, and make the reading. One man provided with the instrument is able to control a wide area, and the method is being extensively used by planters.

New Hellige Outfit.—Objections to the coloured solutions ordinarily supplied for use in the colorimetric method are their limited life, their consequent unreliability, and their continuous expense. Those defects are overcome in the new Hellige colorimeter with sliding double wedge, which is inexpensive, and for which an accuracy of 0·03 *pH* is claimed. In this apparatus the comparison solutions in the double wedge show the observer a continuous colour scale of all possible colour variations within the entire *pH* range of the indicator used, while the colour fields are in juxtaposition and entirely uniform, as the double wedge and cell have plane and parallel walls. Stock acid or alkaline solutions for the double wedge keep accurate for years and their inexpensive renewal is done in one minute. However, for tropical work the form of Hellige Comparator having discs with coloured glasses still remains standard. It can be recommended as a thoroughly reliable apparatus for sugar factory and refinery *pH* work.

A New Prime Mover.—Engines using hot air as their expansive medium have very high theoretical efficiencies, but have not found any important application in industry, as in practice only small pressure changes are possible, and frictional losses are very great. In a paper, which has aroused very special interest in engineering circles, read recently before the Royal Society of Arts, London, J. F. J. Malone, dealt with a new type of engine.[3] In principle it is similar to the hot air engine, but uses water as the thermo-dynamic medium. Its features include its good efficiency, the small quantity of medium required (less than 1 lb. per H.P.), its freedom from wastage, its ability to use cheap fuels, and its silence and elasticity. Allowing for furnace and mechanical losses, 20 per cent. overall efficiency between the heat in the coal and the shaft H.P. can be expected in an engine weighing 330 lbs. per indicated H.P. It is claimed to generate power 33 per cent. cheaper than the most efficient superheated steam engines. In operation it is extremely simple; it has no gears, one lever only being required for power variations or reversibility. It is described as ideal for duty in places where water is scarce, and only wood or waste vegetation is available.

---

1 Theo. O. Nickelsen in *Sugar News*, 1931, 12, No. 9, 641.
2 *Proc. 5th Congress of South African Sugar Technologists' Association*, 1931, page 34.
3 *Journal of the Royal Society of Arts*, 1931, 79, No. 4009, 680-709.

FARREL-BIRMINGHAM

COMPANY INC.

351, Elizabeth Street, ANSONIA, CONN., U.S.A.

SUCCESSOR TO
FARREL FOUNDRY & MACHINE CO. (Est. 1848)
BIRMINGHAM IRON FOUNDRY (Est. 1836)

Representatives :

E. H. THOMAS, Manager New York Office, 79 Wall Street, New York City.

FRANK L. ALLEN, Aguiar 73, Havana, Cuba.

ENRIQUE ABARCA, San Juan, Porto Rico.

MAX W. BOLBY, Calle Alsina 743, Buenos Aires, Argentine.

AYRES & SON, Avenida Rio Branco, 7C. Pernambuco, Brazil.

EDWARD J. NELL CO., 680 Dasmarinas, Manila, Philippine Islands.

FARREL SUGAR MACHINERY:

Cane Grinding Mills; Single, Double and Multiple Crushers; Gear Drives for Mills and Crushers; Cane Knives; Cane Levellers; Cane Carriers; Intermediate Carriers; Juice Strainers and Trash Elevators; Rolls (complete); Roll Shells; Hydraulic Pressure Regulators; Hydraulic Accumulators; Speed Reduction Units; Cast Tooth, Cut Spur and Cut Double Helical Gearing; Repairs of all kinds.

Farrel Cane Mills and Crushers:

Built in single, three-roller mills or in tandems of six, nine, twelve, fifteen or more rolls with or without a crusher. Massive, well proportioned housings with metal disposed to best advantage; improved hydraulic cap of simple construction with removable cylinder having only one packing; crown wheels with specially designed teeth to give maximum variation of roll centres. Accessibility and interchangeability of parts a particular feature. Used by leading sugar producers in all parts of the world.

Farrel Rolls:

Made of a mixture of metals, which produces a hard iron of very open grain, demonstrated to be the most satisfactory by over fifty years' experience and hundreds of rolls in successful operation. Texture and quality of iron in roll shells a factor in obtaining high extraction and tonnage. Method of construction a positive prevention of shells becoming loose on the shaft.

Farrel Revolving Cane Knives:

For shredding and cutting any kind of cane, making a compact blanket which provides more uniform feed to the crusher. Made with specially shaped knives having serrated edges (patented) which increase shredding action. Expand mill capacity and raise sucrose extraction. Arranged for electric motor, engine or belt drive. Maintenance cost is negligible.

Engineering Data, Specifications and Quotations on request.

NEW RECORDS FOR PRODUCTION AND PRECISION ARE MADE ON FARREL-BIRMINGHAM MACHINES

Publications Received.

Report of the Government Chemist (United Kingdom), 1931. (H.M. Stationery Office, London). 1931. Price : 9d.

This Report makes various reading. It is stated that four samples of raw sugar were found to contain a "considerable proportion" of formic acid. Probably formaldehyde had been added at some stage of the manufacture of such sugar for the preservation of its juice or syrup, being later gradually oxidized on contact with air. It will be remembered, however, that RAMSAY found[1] that during the heating of saccharine liquids formaldehyde is formed; and that YODER and TAGGART showed[2] that in the first molasses from juice without any added formaldehyde an appreciable amount of HCOH could be found.

Handbook of Chemistry and Physics. Compiled by Charles D. Hodgman, M.S., and Norbert A. Lange, Ph. D. Fifteenth Edition. (Chemical Rubber Publishing Co., of Cleveland, Ohio, U.S.A.). 1931, Price : \$5·00.

Last year we noticed the publication of the 14th edition of this Handbook.[3] It is a remarkably complete *recueil* of definitions, constants, tables and miscellaneous information, and its value in this country does not seem to be sufficiently appreciated. So far as chemical and physical data are concerned, it would appear to be the most complete of the several books of this class. This 15th edition contains a number of revisions, the principal of which concerns the table of physical constants of inorganic compounds. It is a very valuable work of reference for the laboratory.

The Glycosides. E. F. Armstrong, D.Sc., Ph.D., F.R.S., and K. F. Armstrong, B.Sc. (Longmans, Green & Co., London). 1931. Price : 12s. 6d.

This Monograph is devoted entirely to the glycosides which formed a section only in the writer's former work on the Simple Carbohydrates.[4] Very definite progress has been made in this field, which information is now brought together in one book. As the authors remark, "we cannot know too much of the methods of the plant, the great worker of synthetic miracles. Solar energy, carbon dioxide, a catalyst and the directive forces of Nature daily perform the task of creating the living world."

Über Kolloide in der Melasse. Alex. von Brodowski. Dissertation No. 577; (Theodor Steinkopff, Dresden, Germany).

This is a student's doctorate thesis, and we must remark that for such it is well above the average. A beet molasses was analyzed, and examined for its physical-chemical properties. To this end, the colloids present were for the greater part isolated by dialysis, being separated into different fractions, which were analysed, and yet further examined This has made a very complete and thorough research, which usefully contributes to the literature of molasses, and in spite of the difficult and tedious nature of the experimental work.

A Analyse da Canna de Assucar e seus Productos e a Fabricação do Assucar em Campos. Oduvaldo do Nascimento Matta. (Ministerio da Agricultura, Rio de Janeiro, Brazil). 1931.

Brazil is making efforts to organize her sugar industry on up-to-date lines; and it was reported recently that a Technologists' Association similar to the bodies existing in other countries is projected. In this book the author contributes information on chemical control methods, and on methods of sugar-making, that cannot fail to be of service to his fellow-chemists is the realization of their aims at modernization.

1 *I.S.J.*, 1909, 100. 2 *I.S.J.*, 1910, 239-245. 3 *I.S.J.*, 1930, 425. 4 *I.S.J.*, 1920, 226.

Review of Current Technical Literature.[1]

VISCOSITY OF CANE MOLASSES. **T. A. E. Barker.**[2] *Report, Department Science and Agriculture, Barbados,* 1930-31.

In a massecuite undergoing crystallization, the supersaturation and the viscosity both increase as the temperature falls, the first factor, therefore, promoting crystallization, and the second hindering it. With a view to finding an optimum temperature at which to conduct crystallization, the variation of the viscosity with change of temperature was investigated, molasses being the material used. Three methods of determining the viscosity were tried. In the first a tall cylinder was filled with the molasses ; a steel ball bearing was dropped in ; and the time taken to fall to different depths was noted ; but it was difficult even with arc light illumination to follow the fall of the ball, which moreover was inclined to roll down the sides of the cylinder. In the second and third methods elaborations of the capillary tube method were used, in the latter with temperature control, the close agreement between determinations at the same pressure and temperature showing the method to be a suitable one. Two series of tests were made on these lines, using molasses showing the following figures :—

	Sample 1.	Sample 2.
Total solids	80·79	77·66
Sucrose	38·58	38·99
Purity	47·75	50·22
Supersaturation at 30°C.	1·15	0·99

In spite of the incompleteness of the results, both samples showed the viscosity to change rapidly up to 50-55°C., above that the change being slow, becoming practically constant at 65°C. *Thus, assuming that a low viscosity favours a rapid crystal growth the optimum curing temperature as far as viscosity is concerned is above 50°C.* Following are shown the data from which this conclusion is obtained :—

SAMPLE I.—TOTAL SOLIDS = 80·79 PER CENT.

Temp. °C.		27·4	31	35·5	40	44
Viscosity determinations C.G.S. Units	1	67·045	43·940	32·919	21·625	14·958
	2	66·511	44·635	32·063	21·082	14·182
	3	68·049	45·353	32·982	20·801	14·522
	4	65·711	44·043	—	—	14·814
Mean Viscosity		66·82	44·50	32·65	21·17	14·62

Temp. °C.		50	54	63	65
Viscosity determinations C.G.S. Units	1	8·086	5·538	4·147	3·942
	2	8·437	5·587	4·539	3·510
	3	7·818	4·710	5·011	4·847
	4	—	—	—	—
Mean Viscosity		8·11	5·55	4·57	4·123

SAMPLE II.—TOTAL SOLIDS = 77·66 PER CENT.

Temp. °C.		28·5	35	40	45	50
Viscosity determinations C.G.S. Units	1	25·79	12·60	7·64	5·09	4·81
	2	26·04	15·64	8·36	6·25	4·33
	3	26·43	14·41	8·41	6·83	5·045
	4	27·80	13·25	8·59	7·02	5·42
Mean Viscosity		26·51	13·98	8·25	6·29	4·90

Temp. °C.		55	60	65	70
Viscosity determinations C.G.S. Units	1	3·44	2·407	2·022	1·63
	2	3·72	2·539	1·911	—
	3	3·01	2·734	2·320	—
	4	3·81	2·495	2·585	—
Mean Viscosity		3·51	2·54	2·21	1·63

2 Assistant to Professor of Chemistry, Department of Science and Agriculture, Barbados.

Increasing the Polarization of Raw Sugars by the Torula Inoculation Process. **Anon.** *Communicated to this Journal.*

In the particulars recently published on this process of preventing raw sugar deterioration, it was pointed out that torula ferment the levulose, thus increasing the polarization. But a certain loss of weight is thus incurred, and the question arises what the nett result is, due on the one hand to increased polarization, and on the other to the decreased weight of the raw sugar. In reply to this, it may be pointed out that the increased polarization takes place in two stages, the first being an initial rise at the time of filming. This is not due to loss of levulose in the mass of sugar, but to the displacement of the original low grade molasses film with one of high purity and higher polarization. True, the levulose is destroyed in the inoculating material before it is sprayed on the sugar, but the elimination of this dark coloured, worthless sugar increases the boiling house efficiency and permits a higher yield of raw sugar. During storage there is a loss of weight due to loss of reducing sugars. For every degree rise in polarization there is a loss of about 0·6 degree of reducing sugars, of which approximately 51 per cent. represents loss of weight. Therefore a ton of sugar rising one degree in polarization *after* storage would lose : 2000 × 0·006 × 0·51, equals 6·12 lbs., which loss is more than compensated for by the increased value of the sugar of higher polarization.

Regarding loss of moisture, there is an increase in polarization naturally, to compensate for this loss which is quite small. However, the treated sugars will carry more moisture, more weight per unit of sugar crystals than the untreated on account of the more dilute film surrounding the crystal. This is illustrated in many instances in which treated sugars have a higher factor of safety and still *increase* in polarization instead of decrease, showing no deterioration but an actual gain. The following illustration, will show how the sugar can carry more molasses around the crystal without depressing the polarization. A Cuban molasses was taken and a portion inoculated with torula. Two weeks after inoculation both portions were analysed.

	Original Molasses.	After Two Weeks Inoculation.
Corrected Brix	71·30	68·39
Polarization	49·60	52·00
Purity	69·50	76·00
Reducing Sugars	11·49	6·50

Now the sugars filmed with the treated and untreated molasses polarized at the time of filming 94·6 and 93·2 respectively, but at the end of a month in storage, the untreated sample dropped to 92·2 and the treated sample rose to 96·2, in spite of the fact that the factor of safety for the sample, that is the ratio of non-sucrose to moisture, indicated that it was unsafe.

Progress in Crystallization (improved Lafeuille Crystallizer Pan). **Fernand Lafeuille.** *Facts about Sugar*, 1931, **26**, No. 8, 354-356.

In this article the author recounts how when manager of a pre-war factory in France, confronted with lack of space, he was led to evolve a new type of crystallizer having a much increased capacity. Characteristics of the apparatus were : (1) an enormous surface for heat exchange so distributed that during one revolution all the massecuite came into contact with a bundle of tubes; and (2) the absence of all interior mechanism. It was found that decided increases in yield were attained with the high grade massecuites, those which previously had given 45 now gave 60-65 per cent. With low grade massecuites considerable time was gained, while purities at least as low as in ordinary crystallization resulted. At the same time it was noticed that syrup of a certain purity introduced into the apparatus during the cooling left some times with a purity lower by several points. Cooling in the rotary apparatus therefore resulted in an effect similar to that of boiling in a vacuum pan. The Raffinerie Say, the Egyptian sugar interests in Cairo and others became interested, and bought several of the new crystallizers. Three were exported to Sao Bento, Brazil, and several went out to Java.

Then came the crystallizer pan, the idea of which is described as follows: "To modify my crystallizer by connecting it with a condenser, and to connect my tubular system with steam or hot water so as to give a new apparatus called the crystallizer-pan. It was built to receive the massecuite prepared in an ordinary pan, with a Brix low enough to allow of easy and rapid transfer. The transfer having been made, instead of proceeding immediately with the cooling, we began by continuing the concentration, thus increasing the Brix of the massecuite by two to four points. It was not until after this secondary concentration that we began to cool. The amount of water which we had to take out of the massecuite in order to raise its density a few points was comparatively small. There was no need to provide very large vapour piping for the admission of steam. All this of course simplified the construction." Five of these machines were installed in four Java factories during 1927-28, and after some modification of the method of jointing the tubes and the cast-iron U-tubes for their connexion, results surpassing hopes were obtained. "Instead of 17 points purity drop obtained with the ordinary method without cooling, or 27 points purity drop obtained with cooling in the rotary apparatus, we obtained purity drops of 37, 40, 42 and even 43 points. Massecuites of 83° purity transferred into the crystallizer pan and concentrated to 97-98°Brix, cooled with dilution during the cooling, and finished with a final purity of the mixture of about 77-78°, gave consistently molasses of 46° purity and sometimes even lower."

A BETTER REFINING QUALITY OF RAW SUGAR IS DEMANDED. **Glicerio T. Pison.**[1] *Sugar News*, 1931, 12, No. 9, 624-625.

Refineries are demanding a better quality of raw sugar, and with the market in its present condition they are easily able to discriminate between a good and a bad quality of raw sugar, basing the price accordingly. In fact some marks are refused. They may polarize well, but have been found invariably to give trouble in filtration, so as to slow down the rate of the sugar-house. An American refiner's report on a certain raw sugar stated that it had only about half the normal filtration rate of a good raw sugar: that notwithstanding an increase in filter-aid of 25 per cent. "the process ran miserably"; that the cake had to be washed twice as much as usual; and that in consequence an excessive amount of sweet-water was formed, which of course had to be evaporated. In the table here reproduced are given analyses of poor and of good raw sugars, and also the figures which may be accepted for a standard quality.

	Poor Sugar.	Good Sugar.		Standard Sugar.
Polarization	96·28	97·33	Around	97·00
Moisture per cent.	1·24	0·65	About	0·75
Ash (Carbonate) per cent.	0·40	0·21	Around	0·30
Clarity mm. (original)	18·33	66·14	Above	50·00
Clarity mm. (washed)	38·58	90·00	Above	75·00
Colour on 100 Brix (original)	94·84	46·42	Below	60·00
Colour on 100 Brix (washed)	23·55	9·19	Below	15·00
Filtration rate: per cent. 4,400 grms.	26·45	64·20	Above	52·00
Insolubles: Mgrm. per 100 grms.	127·62	16·97	Below	30·00
Size of grains:—				
Very large per cent.	1·19	26·66	About	10·00
Large per cent.	6·89	34·54	,,	20·00
Medium per cent.	22·06	45·50	,,	45·00
Small per cent.	36·40	8·63	,,	15·00
Very small per cent.	27·73	3·19	,,	10·00
Total small per cent.	64·13	11·12	,,	25·00
Dye Value	400·00	200·00		250·00

Some raw sugar manufacturers seem to have the idea that producing a good quality of raw sugar means extra expense; but this is not so. It requires only extra care. Results depend primarily on clarification, which is controlled by proper liming

[1] *I.S.J.*, 1931, 512.

and sufficient time, while an adequate capacity for settling is of course necessary. Once the proper conditions for clarification are attained, the juice is easier to handle, boiling and centrifuging are both hastened, and less steam and time are used than with careless control. In fact, good raw sugar can be produced at less expense than that required to make a poor quality.

ON THE DESIRABILITY OF A SUITABLE BAGASSE SCALE. **M. A. Rosales.** *Sugar News*, 1931, **12**, No. 9, 627-628. Arguments are set forth (unnecessarily) showing the desirability of including the direct determination of the weight of bagasse in an exact scheme of positive milling control. But to carry this into effect is not an easy problem. An automatic bagasse scale was installed in one of the centrals in Occidental Negros in 1926, but was abandoned, due (one presumes in the absence of any published results) to mechanical difficulties. Yet such a scale is urgently required. Considering that much time and money is spent every year on the control of factories, and only an empirical balance and recovery account is obtained, it is clear that the value of such an improvement would be a great one. A reliable apparatus would eliminate some of the errors now experienced from faulty weights, analyses and calculations. MANUFACTURE OF INSULATING BOARD. **J. S. Bates and A. A. MacDiarmid.** *Pulp and Paper Magazine* (Canada), 1931, **31**, 657-659, 674. This article gives a description of a plant and process for the manufacture of insulating board from wood waste, which may be of use to those investigating the question of bagasse utilization for the same purpose.—PALM SUGAR. **Anon.** *Bulletin of the Imperial Institute*, 1931, 332. In the chemical division of the Department of Agriculture, Ceylon, analyses of a large number of samples of the saps of the kitul and palmyrah palms were carried out. Results indicate that kitul sap has a higher sucrose content (about 12 against 8-10 per cent.) than palmyrah. THE HERISSON CRYSTALLIZER. **Anon.** *South African Sugar J.*, 1931, **15**, No. 9, 579. A reply to the criticisms of HONIG and ALEWIJN.[1] " The increase in power does not exceed 20 to 25 per cent., but the tightening effect on the massecuite is so great that care has to be taken to dilute the massecuite or the whole mass will solidify. Any crystallizer doing its work efficiently will meet with the same difficulty. The increase in power is caused through the efficient mixing of the massecuite. Only the Lafeuille and the Herisson, as far as we know, have this special mixing, which is all important. With regard to uneven cooling; this argument was brought up here in 1928, but after careful tests at one factory, it was found to be unimportant. With regard to the cooling rate, the present design can cool, and is cooling, down massecuites in 4 hours, but if the same cooling surface as the Werkspoor was utilized this time could be reduced to 2 hours, which is much faster than is required. The Herisson Crystallizer has replaced three other makes of cooling gear in this country which were discarded subsequently. There is no doubt there is no more efficient crystallizer on the market."—DETERMINATION OF THE PRICE OF CANE TO THE PLANTER IN SOUTH AFRICA. **G. S. Moberly.** *S.A. Sugar Yearbook*, 1931, 60. A simplification of the formula of the Fahey Conference Agreement is to multiply the current value of raw sugar by 0·38281 and add 0·68428. Thus, say the day's price of raws (in South Africa) is £15. 8s. 4d., or £15·41667, this × 0·38281 is 5·90166, and this added to 0·68428 = 6·58594, the value of 1 ton of sucrose in cane. If the sucrose content of the cane is 13 per cent., then 6·58594 × 13·0/100 = 0·85617, or 17s. 1½d., the price of 1 ton of 13 per cent. cane. In the C. G. SMITH group of factories, the value of 1 ton of sucrose is found by multiplying the average price of refined by 0·33654.

J. P. O.

SACCHARIN.—In the report on synthetic sweetening agents, Dr. Walter Herzog points out[2] that while no new methods have been elaborated for the production of " Dulcin " (para-phenetol carbamide), a good deal of investigation has been carried out for the purpose of increasing the field of application of these substances. Thus it has been found that " Dulcin " in small quantities is an especially useful additive to dilute organic acids used for the preparation of pickles.

---

[1] *I.S.J.*, 1931, 402. [2] Supplement to the *Chemiker Zeitung*, October 14th, 1931.

Sugar Crops of the World.

(*Willett & Gray's Estimates at November 19th,* 1931.)

	Harvesting Period.	1931-32. Tons.	1930-31. Tons.	1929-30. Tons.
United States—Louisiana	Oct.-Jan.	145,000	164,012	178,223
Porto Rico	Jan.-June	835,000	699,252	773,310
Hawaiian Islands	Nov.-June	900,000	889,544	825,891
West Indies—Virgin Islands	Jan.-June	2,000	1,800	5,736
Cuba	Dec.-June	§3,000,000	3,122,186	4,671,260
British West Indies—Trinidad	Jan.-June	90,000	98,573	79,848
Barbados	,, ,,	62,000	50,445	65,517
Jamaica	,, ,,	65,000	55,600	67,847
Antigua	Feb.-July	14,000	8,000	18,550
St. Kitts	Feb.-Aug.	15,000	14,970	18,701
Other British West Indies	Jan.-June	5,500	6,000	5,861
French West Indies—Martinique	Jan.-July	39,000	36,900	37,534
Guadeloupe	,, ,,	28,000	24,400	26,914
San Domingo	Jan.-June	365,000	361,482	360,259
Haiti	Dec.-June	18,000	18,811	18,907
Mexico	,, ,,	200,000	229,500	209,730
Central America—Guatemala	Jan.-June	32,000	31,726	33,400
Other Central America	,, ,,	72,000	93,723	70,600
South America—				
Demerara	Oct.-Dec. and May-June	110,000	113,402	117,254
Surinam	Oct.-Jan.	14,000	16,500	12,500
Venezuela	Oct.-June	18,000	20,000	22,000
Ecuador	June-Jan.	20,000	20,000	19,196
Peru	Jan.-Dec.	514,000	485,077	422,356
Argentina	May-Nov.	365,000	381,792	340,479
Brazil	Oct.-Sept.	975,000	900,000	1,003,903
Total in America		7,903,500	7,843,695	9,405,776
British India	Dec.-May	3,100,000	3,178,000	2,761,000
Java	May-Nov.	2,500,000	2,843,000	2,923,010
Formosa and Japan	Nov.-June	920,000	906,090	923,873
Philippine Islands	,, ,,	800,000	785,242	773,674
Total in Asia		7,320,000	7,712,332	7,381,557
Australia	June-Nov.	535,000	538,641	532,591
Fiji Islands	,, ,,	80,000	90,000	87,680
Total in Australia and Polynesia		615,000	628,641	620,271
Egypt	Jan.-June	95,000	90,000	98,303
Mauritius	Aug.-Jan.	175,000	190,000	238,030
Réunion	,, ,,	35,000	50,415	51,020
Natal	May-Jan.	300,000	350,901	266,638
Mozambique	May-Oct.	85,000	85,000	78,644
Total in Africa		690,000	766,316	732,635
Europe—Spain	Dec.-June	12,500	14,000	13,562
Total cane sugar crops		16,541,000	16,964,984	18,153,801
Europe—Beet sugar crops†		8,335,000	10,578,014	8,248,509
United States—Beet sugar crop††	July-Jan.	1,010,719	1,075,688	901,713
Canada—Beet sugar crop††	Oct.-Dec.	38,500	40,953	27,869
Total beet sugar crops		9,384,219	11,694,655	9,178,091
Grand total Cane and Beet Sugar ...... Tons		25,925,219	28,659,639	27,331,892
Estimated increase in the world's production ,,		2,734,420	*1,327,747	230,208

* Increase. †† Refined Sugar. § Subject to Government Regulation.

† European Beet Crop Figures are furnished principally by F. O. Licht.

United States Atlantic Ports.

(*Willett & Gray*).

(Total of 2,240 lbs.)	1931 Tons.	1930 Tons.
Total Receipts, Jan. 1st to Nov. 21st	2,202,977	2,381,291
Deliveries „ „ „	2,292,718	2,672,319
Meltings by Refiners „ „	2,333,124	2,690,074
Exports of Refined „ „	41,000	42,000
Importers' Stocks, November 21st..	69,151	146,243
Total Stocks, „ „	108,221	288,082
	1930	1929
Total Consumption for twelve months	5,599,377	5,810,980

Cuba.

RECEIPTS, EXPORTS AND STOCK AT NOVEMBER 21ST.

(*Willett & Gray*).

	1931 Tons.	1930 Tons.
Production to date	3,122,186	4,671,260
Less Cuban Consumption to date	115,000	135,000
	3,007,186	4,536,260
Stock at Shipping Ports	649,969	837,940
Total Exports	1,360,694	2,705,755
Total Receipts at Shipping Ports	2,010,663	3,543,695
Stock on Plantations and in transit to Ports	996,523	992,565
Total Sugar in Cuba (partly estimated)	2,001,324	1,830,505

Beet Crops of Europe.

(*Willett & Gray's Estimates at November 19th,* 1931).

	Harvesting Period.	1931-32. Tons	1930-31. Tons.	1929-30. Tons
Germany	Sept.-Jan.	1,650,000	2,528,591	1,966,782
Czecho-Slovakia	Sept.-Jan.	830,000	1,125,690	1,022,116
Austria	Sept.-Jan.	165,000	150,269	120,375
Hungary	Sept.-Jan.	145,000	234,171	246,496
France	Sept.-Jan.	910,000	1.196,182	909,622
Belgium	Sept.-Jan.	240,000	283,234	252,048
Holland	Sept.-Jan.	180.000	299,523	267,824
Russia and Ukraine	Sept.-Jan.	2,150,000	2,010,150	950,000
Poland	Sept.-Jan.	560,000	791,951	928,757
Sweden	Sept.-Dec.	142,000	186,535	121,404
Denmark	Sept-Jan.	125,000	167,800	134,300
Italy	Aug.-Oct.	360,000	420,244	440,822
Spain	July-Feb.	347,000	345,000	273,955
Switzerland	Sept.-Jan.	6,000	5,704	5,800
Bulgaria	Sept.-Jan.	28,000	58,136	41,762
Roumania	Sept.-Jan.	65,000	162,500	82,230
Gt. Britain and Ireland††	Sept.-Jan.	291,000	447,486	311,074
Jugoslavia	Sept.-Jan.	80,000	103,977	131,639
Other Countries	Sept.-Jan.	61,000	60,871	41,503
Total in Europe†		8,335,000	10,578,014	8,248,509

† European Beet Crop Figures are furnished principally by F. O. Licht. †† Refined Sugar.

United Kingdom Monthly Sugar Report.

Our last report was dated November 6th, 1931.

Once again the depreciation in sterling has played a great part in fixing the price of sugar in London. Since our last report sterling has fallen from $3·75 to $3·25, and although this depreciation has not been altogether reflected in the price of the commodity, sugar has advanced fully 6d. per cwt.

There have been active dealings in the Terminal Market and over 20,000 tons were tendered on December. This month rose from 6s. 3d. to 6s. 11d., March sold at 6s. 6½d. to 7s. 2d., May from 6s. 8½d. to 7s. 4d. whilst August moved from 6s. 10½d. to 7s. 6d.

The continent, which at one time was forced to sell some of its production for financial reasons, appears now to be out of the market as a seller and nothing apparently can be bought except at much higher prices.

The trade continued to buy on a hand to mouth policy, until last week when they came in with a rush and bought three weeks to a month's supply. The refiners who recently were selling for export were forced in consequence to raise their prices, which to-day stand at 3d. per cwt. higher than a month ago, viz., Tates No. 1 Cubes 24s., London Granulated 20s. 4½d.

Business in Raws has not been large to the refiners, as to a great extent they were supplied by Home Grown Beet and Australian 96°. However, some cargoes and parcels have changed hands from time to time from 6s. 6d. down to 6s. 3d., but in the last few days the refiners have paid 6s. 9d. and 6s. 10½d. There are no sellers at the moment under 7s. c.i.f.

With regard to Cuba, the carry-over will be approximately 600,000 tons more than was expected, so it appears probable that the next Cuban crop will be reduced by this amount.

Mr. Chadbourne is reported to be coming over to Europe and it is rumoured that the export quotas under the Chadbourne plan of the European countries and Java will be reduced.

F. O. Licht again reduced his estimate of the European beet crop by 110,000 tons, his figure to-day, excluding Russia, being 6,100,000 tons, against 8,631,000 tons.

Arthur B. Hodge,

Sugar Merchants and Brokers.

21, Mincing Lane,

London, E.C.3.,

8th December, 1931.

INDEX TO VOLUME XXXII.

GENERAL INDEX.

[(N.C.) implies *Note and Comment*; (Par.) *Paragraph*; (Corr.) *Correspondence*; (Abs.) *Abstract*; (D.O T. Report) *Department of Overseas Trade Report*.]

NAMES.

General.

PUBLICATIONS RECEIVED.

SUBJECT MATTER.

NAMES.

PATENTS.

SUBJECT MATTER.

NAMES.